COLONY OF THE GAMBIA.

IMPERIAL MYCOLOGICAL INSTITUTE
22 OCT 1931

THE ANNUAL REPORT

OF THE

DEPARTMENT OF AGRICULTURE

FOR THE YEAR ENDED MARCH 31ST, 1931.

Price 5/-

PUBLISHED BY THE CROWN AGENTS FOR THE COLONIES,
4, MILLBANK, LONDON, S.W.1.

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DEPARTMENT OF AGRICULTURE THE GAMBIA.

REPORT

OF THE

DIRECTOR OF AGRICULTURE

FOR THE YEAR ENDED MARCH 31ST, 1931.

GENERAL AGRICULTURAL CONDITIONS.

The climatic conditions during 1930 were favourable in all Provinces, and good crops of rice, guinea corn, millet and maize were harvested. The areas devoted to groundnut cultivation were greater than on any previous occasion.

Disease was below normal. A record crop of between 80,000 and 85,000 tons of groundnuts was confidently expected, and this estimate was commonly recorded by those who had intimate knowledge of the general conditions in the Protectorate during the growing season.

Locust Invasions.

On 12th November, 1929, a flight of locusts (*Locusta migratoriodes*) was observed passing over Jawarra in a westwardly direction. All surrounding towns and villages were warned. Two weeks later, similar flights passed over McCarthy Island, still flying westward, and a certain amount of damage was done to food crops. Instructions were issued to the farmers to have all mature crops instantly reaped, and to protect the immature crops with smoke screens made by burning green bush and grass. These instructions were carried out and watches kept.

Neighbouring villages were warned of the approach of further flights. Within a few weeks, further flights were reported from each Province. Excellent work was done by the farmers in burning up the swarms as they settled on the bush, but the real trouble commenced in June, 1930, when the new crops had been sown and germination commenced.

Hoppers which had hatched from eggs laid by the swarms referred to made their appearance in great numbers and in numerous places throughout the Upper River, South Bank, North Bank, and McCarthy Island Provinces.

A special Bulletin, No. 4, dealing with the "Control of Locusts," was prepared and freely distributed locally. This bulletin gave detailed instructions for dealing with the hoppers, and contained sketches showing how metal barriers should be erected and used in conjunction with open trenches. Metal barriers were made and sent to the infested districts to assist the farmers in their fight against this natural pest. I cannot speak too highly of the work performed by the farmers, working in co-operation with their Travelling Commissioners, Chiefs and Agricultural officers in getting the locusts under control, and it is entirely due to this organised attack that comparatively so little damage was done. Moreover, it is very satisfactory to be able to state that very few, if any, of the locusts which hatched in the Gambia escaped to invade neighbouring territory. The bands of hoppers

were driven slowly forward into open trenches flanked with metal barriers, where they were destroyed by spraying with petrol and lighting it, or by filling in the trenches with soil. Where these methods could not be employed they were driven on to heaps of prepared prickly bush and burned, or where the undergrowth or forest would not permit these methods being employed, they were destroyed by spraying the area with poison washes or by depositing poison baits. By the end of the year, this particular species of locust was entirely cleared out, and no specimen has been observed since.

Damage to Native Food Crops.

Rice cultivation suffered severely in the Illiasa district of the North Bank Province and further late sowings had to be made. It is worthy of record that in this emergency the men turned out to assist the women in this work. Normally, rice is grown only by women in the Gambia.

Severe damage was also done to rice fields in Central and Western Jarra of the South Bank Province.

Guinea corn farms suffered individual damage here and there, more particularly in the McCarthy Island and North Bank Provinces.

In view of the magnitude of the invasion we were extremely fortunate to escape with so little damage to food crops generally.

Groundnut cultivation suffered no damage.

All crops except root crops such as cassava, sweet potatoes, etc., were reaped by the end of December, and no further sowings will be undertaken until the rains commence in May, 1931. Early in January, when we were beginning to feel that our troubles were over, at least in so far as locust invasion was concerned, another and more formidable specie—the Desert Locust (*Schistocerca gregaria Forsk.*)—arrived in myriads from French Senegal. Although farm lands were devoid of field crops, gardens suffered very severe damage; plots of cassava, potatoes, beans, pawpaws, and so forth being entirely defoliated in the districts where the locusts appeared. At Illiasa, where I arrived on 8th January, I found the farmers engaged in burning up the surrounding farm land, which was covered with this locust. Unfortunately, no sooner was one swarm accounted for in this way than succeeding swarms appeared on the recently-burned ground. In some districts in the North Bank Province the swarms were so dense that the whole countryside for miles around, including women and children working in the fields, were covered with locusts. In view of these conditions, I deemed it necessary to advise taking no further action to deal with these swarms in transit, but to reserve all our energies and resources for a concerted attack towards sowing time in May, when I fear we shall require increased facilities for dealing with the hoppers, which are almost certain to then appear.

Conditions in neighbouring French Senegal at the time of my visit were equally bad, if not worse.

Groundnuts.

The Government notice fixing the buying season for groundnuts as from 1st December to 30th April, which had been in force for some years, was cancelled, but little or no buying took place until the usual time.

The crop raised is beyond doubt the largest which has ever been grown in the Gambia, excluding the nuts which are annually brought in from French Senegal. This may appear strange to the uninitiated when it is realised that the local market

value of groundnuts has been falling steadily since 1920 when the local price paid was 5s. 6d. per bushel of 28 lbs. By 1929 the price had fallen to 1s. 7½d. lb. per bushel, but notwithstanding this fact the farmers considerably increased their areas under this crop. The explanation is that for some years past the officers of this Department have been impressing upon the farmers the fact that the steady decline in price was largely due to the Indian farmers having considerably increased their output, and it was pointed out that if the Gambian farmer wished to obtain sufficient money each year to pay his debts and supply his needs, he would be forced to increase his area under groundnuts to make good the drop in price, as he could not reasonably expect the former good prices to be again realised. He was advised that when sowing his land he should not expect to receive more than 1s. per bushel for his crop at harvest time, and he should therefore plant accordingly. His mistake in the past had been to expect as much as 3s. 6d. per bushel, and he only planted such an area as would give him the actual money he required. Experience has proved that the African farmer is not unique in this respect as West Indian farmers have been known to reduce their areas under cotton cultivation when the price has risen abnormally, notwithstanding that the primary object in raising the price was to increase the production; the exact opposite result was obtained.

The Gambia farmers had become more or less reconciled to the steady fall in groundnut prices, and they were quite prepared to meet the situation by increasing their areas so long as the price remained in the neighbourhood of 1s. 6d. per bushel, but they were quite unprepared for the abnormal drop to below 1s., and considerable depression was created when it became known that the opening price for the 1930–31 crop of groundnuts would be 9d. to 1s. per bushel as compared with 1s. 10½d. and 2s. the previous season. This depression was considerably intensified when the price fell rapidly to 3d. and 4½d.

The Gambia farmers are deserving of great credit for the way in which they have been facing a falling market during the last ten years, as they have endeavoured to make good their losses by increased production. A stage has now unfortunately been reached when they can no longer be expected to produce groundnuts at such a low market value, as it does not pay them to do so at prices below 1s. per bushel. We must therefore expect in the coming year that greater attention will be paid to the production of grain crops for local consumption. Fortunately, groundnuts, unlike many other tropical crops, can be used to supplement the local food supply. A Colony dependent therefore on a single export crop such as groundnuts is not in such a precarious position as one dependent upon a single crop such as cocoa, rubber or cotton.

Meetings were held by the Chiefs to consider the situation created by this fall in price, and it was decided not to sell their groundnuts for less than 1s. per bushel as they rightly considered this to be their food value for local consumption. Little or no business was therefore done until the early part of February when the price rose to 7½d. at wharf towns, and 9d. at shipping ports.

By this time the Government had intimated that the collection of the outstanding debts, which amounted to £26,638 18s. 4d., would be postponed for the time being. The farmers were, however, warned that there would be no further issues of rice and groundnut seed by the Government, and that they were to erect additional stores and reserve the extra food supplies and seed required under this change of policy. In view of this and the possibility of the market price again falling, they decided to sell their surplus groundnuts. These were poured into the buying stations at such a rate that considerable difficulty was experienced in seeing that the provisions of the Compulsory Screening Ordinance were carried out.

TABLE SHOWING QUANTITY OF GROUNDNUTS PURCHASED IN EACH PROVINCE, 1927–8, 1928–9, 1929–30.

Province.	Groundnuts. Tons. 1927–8.	Groundnuts. Tons. 1928–9.	Groundnuts. Tons. 1929–30.
Upper River	22,469	16,023	17,670
South Bank	14,954	10,892	16,601
Kombo and Fogni ...	10,591	11,361	14,458
North Bank	15,172	11,231	15,050
McCarthy Island ...	12,200	7,998	13,303
Total	75,386	57,505	77,082

GROUNDNUT DISEASES.

An unfamiliar disease appeared in some of the groundnut plots and material was prepared and submitted to the Imperial Mycological Institute, who reported as follows :—

Diseased Leaves of Groundnut from Gambia.

Ref. : Director of Agriculture, Gambia, 1.10.30.

The leaflets showed large marginal, somewhat zonate spots, with indefinite limits, on most of which no fungus has been detected. The spots on the leaflets of one leaf bore pycnidia containing pycnospores like those of *Macrophomina phaseoli* (Maubl.), Ashby (20–27 × 7–8·5 microns) and cultures have yielded the sclerotial stage of that fungus (*Rhizoctonia bataticola* (Taub.), Butl.). The leaflets in general had a rather pallid appearance indicating a condition of ill-health which may have preceded the spotting and predisposed them to the infection. An examination of the roots might have disclosed a diseased condition or a defective development compared with the roots of quite healthy-looking plants. Is there any reason to suspect unfavourable weather or soil conditions as the predisposing cause of the leaf disease, as it is improbable that *M. phaseoli* would be an injurious parasite on the leaves of healthy plants ?

Diseased Plants of Groundnut from Gambia.

Ref. : Director of Agriculture, Gambia, 27.10.30.

The lower parts of the taproots of most of the plants were bare to the wood, the cortex having decayed away, and a root system was lacking. On the exposed wood and in the cortex of the upper parts of the taproots the small black sclerotia of *Macrophomina phaseoli* were present in abundance. This fungus was the probable cause of the root disease.

It has been recorded as the cause of root disease of groundnut in India by Shaw (*Mem. Dept. Agric. India*, Vol. IV, No. 6, 1912), and again recently by Sundararaman in Madras (*Rev. Appl. Mycology*, VIII, 17, 88, 423). In Madras the disease was restricted to land under irrigation. The application of lime at the rate of 1,000 lb. to the acre reduced the incidence of the disease to one-half.

In Iraq, a root disease of sesame, due to the same fungus, became severe on land following irrigation with water of high salinity during the hot weather (July and August).

It is probable that the variety of groundnut—Philippine Pink—is more sensitive than other kinds to external conditions which lower resistance and predispose to injurious attack by the fungus which investigations have shown to be an active root parasite only under conditions unfavourable to the hosts.

The variety mainly affected, with its upright growth, would probably make larger demands on the available water in the soil than the prostrate kinds and the close spacing would favour the spread of the fungus in the soil from plant to plant.

Shaw found the fungus in the fruit wall of the seeds due to infection from the soil so that infection can be introduced with the seed ; if a proportion of the seeds were infected, close spacing would favour the spread of the fungus to adjacent plants. Seed from a crop grown on land where the disease has occurred might be expected to carry some infection. No data are available as to the most effective and most practicable methods of disinfecting the seed of groundnut. It would be desirable to carry out some disinfection experiments in plots with adequate controls. A number of dusts and steeps have, of recent years, proved successful in the control of other seed-borne diseases. Among the dusts may be mentioned :—

Tillantin R (Bayer Products, Ltd., 19, St. Dunstan's Hill, London, E.C.3). This is now being used in S. Rhodesia against seed-borne diseases of maize.

Abavit B (E. E. Mayer, Fawsitt & Co., 6, Lloyd's Avenue, London, E.C.3). This has done well in Ireland with cereals and is under test in S. Rhodesia with maize.

Semesan Junior (Dupont de Nemours, Wilmington, Delaware, U.S.A.).

Merko (Corona Chemical Division, Pittsburg Plate Glass Co., Milwaukee, Wisconsin, U.S.A.).

The best liquid steeps appear to be :—

Uspulun (Bayer Products, Ltd.).

Semesan (Dupont de Nemours).

Germisan (Saccharine Fabrik, Magdebourg, Germany).

Corrosive sublimate would be worth trying also as a steep (1 part to 1,000 of water, acidified with HCl), soaking for 30 minutes.

The manufacturers or London agents would doubtless supply samples large enough for experimental plot trials.

Changed Economic Conditions.

It is unlikely that the former high prices for groundnuts will ever be regained, at least not for many years to come, and this renders the question of cheaper production vital. For some time past this Department has realised that our position in the groundnut industry can only be maintained by the production of groundnuts of high quality, and by *discovering means whereby the cost of production can be reduced both by increasing the yield for the labour involved, and by lessening the cost of labour by making the Colony less dependent upon imported supplies of food.*

Our groundnut investigational trials are yielding valuable information having a direct bearing upon increased yields, while the investigations being conducted with a view to finding the most suitable and economic plough for general local conditions

are directed towards reducing the cost of labour involved, and towards bringing larger areas under cultivation with the same labour supply. This aspect of the problem is dealt with more fully under the section Ploughs and Ploughing Trials of this report.

Irrigation.

The question of irrigation has received considerable attention by the Government since March, 1903, when an Irrigation Expert from Ceylon visited the Gambia and reported upon its possibilities. A scheme such as was then proposed for the general irrigation of large areas was entirely beyond the resources of the Colony and for that reason nothing was done. When Messrs. Stockdale and Sampson visited the Colony recently they were of the opinion that it would be possible for farmers, situated in suitable localities along the river, to grow food crops during the dry season—November to May—if it were found practicable to establish simple native methods of lifting water such as are in general use in India and Ceylon. It was therefore arranged that an officer of this Department, possessing an intimate knowledge of our local conditions, should visit India and Ceylon to study the various methods employed in raising water with a view to their being adopted in this Colony.

Mr. J. Pirie, Agricultural Superintendent, left for England and the East on 21st March, 1930, and is expected to return to the Gambia in May, 1931. Working models of the most likely contrivances to suit our purpose are being obtained, and a site for the initial experimental work has been selected at Sankuli-Kunda, near Georgetown, 176 miles up river.

PRODUCE INSPECTION.

During the height of the rush when nuts were arriving at the buying stations in excessive quantities some firms found that their available screens could not cope with the daily purchases and in some instances considerable quantities were placed upon the main stacks without screening. These stacks were noted by the inspectors and when transit to shipping ports was commenced rescreening of the cargoes was insisted upon.

RICE AND GROUNDNUT SEED DISTRIBUTION.

For a number of years it has been the custom of the Government to issue considerable quantities of rice and groundnut seed to the farmers to ensure the annual crop being above a certain tonnage.

The rice was intended primarily to feed the strange farmers who come into the Gambia each year from Senegal for the purpose of growing groundnuts. The groundnut seed was to supplement the available seed reserved by the farmers themselves. This policy was economically unsound but force of circumstances justified its adoption at the time, and all went well so long as the European market value of the resultant crop reached a high figure with local prices ranging from 2s. to 3s. a bushel, but as soon as the market value fell below that of the preceding year, difficulties arose when payment had to be made for the rice and seed already consumed.

In 1925, a total sum of £33,481, had to be written off by the Government to relieve the farmers of a debt in connection with this service which they found they were unable to pay. A scheme was then drawn up to provide the farmers with the extra groundnut seed required, and to safeguard the Government from having to write off any further debts in so far as groundnut seed was concerned. This seed was sold to the farmers at a higher rate than they actually received for their crop. The object being to induce them to save their own seed instead of depending upon seed issued by the Government, and further to build up a Reserve Fund from the profits to which could be debited any outstanding debts.

The farmers of the North Bank and Kombo and Fogni Provinces were quick to realise the advantages of saving their own seed, and only called for Government supplies in actual emergencies. The other Provinces, however, depended largely upon Government issues. The drop in the local market value from 2s. 1d. per bushel in 1929 to 1s. 4d. in 1930 brought home to these Provinces the wisdom of saving their own seed, with the result that only 9,461 four-bushel bags were asked for in 1930, instead of 20,209 bags which was the quantity distributed the previous season. It is worthy of note that although the Government seed issued was 10,748 bags below the quantity supplied the previous year, and that there were 2,282 strange farmers less working in the Gambia during the year under review, the groundnut crop *actually grown in the Protectorate*—and not brought into the Gambia from French Senegal—was larger than on any previous occasion. It therefore shows that there is no sound reason why these large distributions on the part of Government should be continued, and the present depressed state of the groundnut market affords a most favourable opportunity of doing away with this system. The farmers of the North Bank and Kombo and Fogni Provinces have clearly demonstrated over a number of years that they can produce maximum crops without this artificial aid, and there is no valid reason why the other Provinces should not do the same. The farmers have therefore been warned that no rice, or seed, will be issued except in actual emergency. The total outstanding Government debt for both rice and groundnut seed issue is £26,638 18s. 4d., of this total £20,603 13s. 4d. is the actual cost of rice supplied as food ; the remaining £6,035 5s. represents the value of groundnut seed distributed, and is covered by the Reserve Fund which has been built up under the Groundnut Distribution Scheme established by this Department in 1926.

STRANGE FARMERS.

The total number of Strange Farmers working in the Gambia during 1930 shows a decrease of 2,282, although the area under cultivation was much greater than in previous years.

The following table shows their distribution :—

Province.	Actual Numbers.			Decrease.	Increase.
	1928.	1929.	1930.		
Upper River ...	7,154	5,521	4,755	766	—
McCarthy Island	2,097	2,030	2,521	—	491
South Bank ...	5,640	5,367	4,214	1,153	—
North Bank ...	2,644	2,545	2,043	502	—
Kombo and Fogni	3,105	3,411	3,059	352	—
Totals ...	20,640	18,874	16,592	—	—

GOVERNMENT GROUNDNUT SEED SUPPLY SCHEME.

Seed Distributed, 1930–31.

The quantity of groundnut seed distributed at the commencement of the rains by this Department to the various Provinces was 9,461 bags, this quantity being 10,748 bags less than the previous year, as the farmers retained larger reserves of their own.

The quantity of seed distributed during the last four years is given in the following table :—

Province.	1927.	Bags containing Four Bushels.			Decrease.
		1928.	1929.	1930.	
Upper River ...	5,316	5,690	6,499	2,868	3,631
South Bank ...	5,163	7,150	8,614	2,693	5,921
McCarthy Island	2,800	3,117	4,000	3,000	1,000
Kombo and Fogni	471	684	696	200	496
North Bank ...	242	400	400	700	—
Totals ...	13,992	17,041	20,209	9,461	—

Seed Nuts Distribution Scheme as at 31st March, 1931.

Expenditure. Particulars.	Amount. £ s. d.	Revenue. Particulars.	Amount. £ s. d.
To purchase of Seed Nuts ...	4,730 10 0	*By* Balance of Reserve Fund at 31/12/1930	9,694 0 1
,, Bags purchased by Government, Season 1930-31 ...	906 5 0	,, Interest at 3½ per cent. from 1/1/31 to 31/3/31 ...	84 16 5
,, Freight on bags from United Kingdom	52 4 11	,, Value of bags in Stock, 13,200 at 1s. 2d.	770 0 0
,, Cost of Distribution	74 14 0	,, Amount outstanding for Seed Nuts supplied ...	6,121 0 11
,, Balance at the end of Season 1930-31	10,906 3 6		
	£16,669 17 5		£16,669 17 5

Owing to the considerable drop in the market value of groundnuts during the year it was decided to issue the seed nuts at 10s. per bag instead of the former price of 18s. For this reason there is only a very small increase in the Reserve Fund over the total of last season, and this increase is mainly due to the 3½ per cent. interest which is now being paid by the Government to this Fund, and which has been credited during the year under review.

PALM KERNELS.

A large number of strong plants have been successfully raised from seed of the two improved varieties of oil palms received from Nigeria in 1930. These will be available for distribution during the coming rains. The inspection of

Visit of the Protectorate Chiefs to the Agricultural Headquarters, Cape St. Mary.

Demonstrating Groundnut Field Trials to Protectorate Chiefs.

Ploughing Demonstration to Protectorate Chiefs. A Light Plough in Action.

palm kernels was satisfactorily maintained during the year. The annual exports of palm kernels for the last five years are as follows :—

Year.	Tons.
1926	676
1927	719
1928	615
1929	735
1930	606

COTTON (*Gossypium punctatum*).

There was a further marked extension in cotton cultivation during the year, particularly in the North Bank Province where many new areas were brought under cultivation. The increased attention now being paid to cotton production is directly connected with the decline in the market value of groundnuts. The spending power of the population has been reduced in proportion to the drop in groundnut values with the result that less imported cotton goods are being purchased. The African farmers and particularly their women folk are falling back upon their home-spun cotton, which is infinitely superior in wearing quality to the imported article. This increase in demand for local pagns has necessitated an increase in the local production of raw cotton, and this increase is being readily met by the farmers. This may not be to the interest of trade generally, but it is to the material benefit of the African himself, and this policy of making himself less dependent upon imported articles is economically sound in principle and practice, and deserves every encouragement. The native species of cotton generally grown is *Gossypium punctatum*, and this local variety shows greater resistance to disease and insect attack than the later introduced varieties. Considerable care is taken with its cultivation and protection, and most of the farms are protected from straying animals by the erection of prickly fences. Under normal soil conditions the plants are small, but when grown on soil which has been fallowed or manured the plants frequently reach a height of 5 feet to 6 feet with a good spread.

Allen Cotton.

The experimental trials with recently imported Allen cotton being conducted by this Department were continued during the year. The first trials proved, as was anticipated, that it was less resistant to insect attack than the local variety, and the lint was not uniform under our conditions. Our selection work with the Allen variety at present aims at obtaining a more uniform lint and greater resistant to insect attack, while the selection work with the native variety has for its object the increase in length of staple. Fuller details are given in the report on Wuli Farm.

SESAMUM (BENNI SEED).

It is regretted that there appears to be no longer a market for sesame, and the farmers who took up this cultivation at the instigation of this Department this year found themselves with a crop which they had considerable difficulty to dispose of, even at an unprofitable figure.

Sesame had been regarded as a promising crop for the Colony, and the initial field experiments extending over some years, and trial shipments made by this Department proved it to be a suitable and profitable crop under Gambia conditions. In 1930, this Department shipped 4 tons 18 cwts., which realised £64 16s. 5d., giving a net profit of £13 7s. 6d. on the transaction.

This result was encouraging, and the farmers were urged to extend their areas. Satisfactory crops were reaped, but for some time there were no buyers, and when a purchaser was found the price offered was much beneath the cost of the labour involved in growing it.

Messrs. Maurel Frères, of Bordeaux, were consulted, and they reported that sesame, which formerly dominated the oil market of Marseilles, has ceased to do so, and added "that so little of this seed now comes to France that there is no market for it. No buyer asks for sesame oil." A market has therefore to be created before a buyer can be found.

Another difficulty to be faced is that most of the oil mills are crushing one kind of seed which offers in large quantities. It is therefore unprofitable for these mills to handle a comparative small quantity of any other seed, as it entails the thorough cleaning of the whole of the machinery involved to free it of the previous oil before the new consignment of a different crop is handled.

Under these circumstances it is advisable for the farmers to grow only sufficient of this crop as they require for their own needs. Valuable local information has been obtained from this work, and it may pay the farmers to grow sufficient each year to retain fresh supplies of seed of the white variety, from which it would be easy to extend their cultivation should market prospects justify them doing so. The foregoing is useful in demonstrating the difficulties ahead, when one is endeavouring to find a second export crop in a Colony with extremely limited agricultural resources and one dependent upon a single staple crop.

PLOUGHS AND PLOUGHING TRIALS.

With over-production in almost every tropical crop in the world, the problem of reducing cost of production becomes a vital factor. So far as this Colony is concerned this can only be done by mechanical means of tillage, which will permit of larger areas being put under cultivation.

The question of ploughs and ploughing has received considerable attention by this Department, working in co-operation with the agricultural authorities and manufacturers in England and France. The problem of finding a suitable hand plough is nearer being solved.

A large number of ploughs have been tested out, including motor ploughs, cattle ploughs and small hand ploughs, including those of English, American, and French manufacture. The ox-drawn plough must eventually prove to be the best and most economical method of ploughing in the Gambia, and there can never be any question as to its superiority when considering the agricultural economy of a country like this.

Moreover, if the Gambian farmer is to retain his present position in the groundnut industry, and successfully compete with his Indian rival, it is essential that he should provide himself as early as possible with the best means for increasing his present cultivation.

Even though a suitable plough has been found, many years are likely to elapse before the farmers can reasonably be expected to take up ploughing generally. It is not a simple question of introducing a new implement of tillage, which so many people who are not conversant with the actual difficulties of the problem think. It means a *complete revolution in our farming methods.* We have to bear in mind that the whole production in this Colony has been carried on for centuries by what is known as "shifting cultivation."

The land has never been cleared of stumps, it being sufficient for past needs to burn off the land each year, and to till and sow between the existing bush, which

is allowed to grow and flourish again once the crop has been reaped. After two years the farms are abandoned and allowed to revert to bush, and new areas are burned off for planting. Sheer necessity alone will therefore force the farmer to remain year after year on the same area, which must be freed of all roots and stumps if ploughs are to be used. This clearing of land for ploughing was demonstrated to the assembled chiefs by the writer, and they aptly replied, " You savy farm work plenty, *but too much work.*" We therefore must not expect any spectacular change in the existing agricultural methods of tillage even when the suitable plough has been found, but rather a very gradual move towards this desirable end.

Tractor ploughs have been employed on our farm at Cape St. Mary and were quite useful, particularly in the earlier years when labour was so scarce. The constant breakages, through inexperience of the native drivers rendered this form of ploughing too expensive to be maintained when labour could be obtained. For general use our aim has been to find a light hand-plough capable of successfully competing with the " Darambo."

The best implement we have found to meet these requirements so far is the lightest plough made by Messrs. Beauvais & Robin, France. Two types were supplied by this firm : one with a straight beam in which the hand-wheel was in a fixed position, with the result that depth of cultivation could not be altered ; the other type has a curved beam with several holes for the axle, giving a fair range over which the depth of cultivation can be carried out. There are attachments with the frames, consisting of a single-furrow plough, a ridging plough cultivator, tines and hoes. With any one of these fixed the implement did not exceed 30 lb., and when ploughing two men were required to pull, but only one when cultivating with the tines. The attachment for ridging consisted of breasts and shares in one piece riveted to the support. It was found that the furrow had too flat a bottom. As a temporary measure, a piece of metal to project further into the soil was fixed on the point of the share, and this was an improvement. The breasts, however, in our opinion, were not concave enough. The land wheel (15 inches diameter) and attachment appeared rather weak, and after prolonged use have worn out of truth, the spokes showing signs of collapse, and the holes in the beam for the axle have worn much larger. Despite these drawbacks, this plough is very promising. Against the native " Darambo " the ridging plough did treble the work, and although the ridging was, perhaps, not quite so high, it was more uniform and no space wasted, as so frequently occurs with the native method.

Apart from its normal use, the ridging attachment has proved extremely useful in cutting shallow drains round the numerous experimental plots to stop erosion. Had hand labour been employed the work would have taken a very considerable time, with the added risk of damage to the plots by trampling. On this work alone, and considering the cost of labour (1s. 6d. per day), this plough has paid for itself several times over.

Arrangements were made for all the chiefs to be present at Cape St. Mary in September to attend a demonstration of the various types of ploughs and to see the field experiments. The Chiefs, who were in the charge of Major R. W. Macklin, Travelling Commissioner, North Bank Province, were conducted round the farm by the Director and the Assistant Director of Agriculture, and the object of each field trial was carefully explained to them. A very useful purpose was served, as it enabled one to discuss many agricultural problems common to all farmers.

The authorities in French Senegal are also endeavouring to find a suitable hand-drawn plough and seed sower for groundnuts and a number of ploughs

and sowers have been imported. One of these ploughs and a sower were included in our trials at Cape St. Mary, but they were found unsatisfactory.

The plough was a single shafted implement with a plate on the handle end intended to rest against the body of the driver giving him extra strength to push. Unfortunately the shaft is not adjustable for height. The attachments were, strictly speaking, more suitable for hoeing than ploughing. The blades were fixed at too wide an angle, thus giving great resistance to the soil. The implement only weighed 37 lb., but it proved too much for two men to pull without strain and frequent rests. This implement proved unsuitable in every way.

The seed sower was intended for groundnuts but the seed holes were not sufficiently large to take the seed of the Gambia varieties. It was therefore tested with Pigeon Pea. The spacing varied from 16 to 18 inches with a variable number of seeds at each place. The seed box and release proved to be too near the ground with the result that the seed holes became constantly choked with soil. The greatest drawback was that spacing could not be adjusted. A seed sower can only be employed when flat instead of ridge cultivation is followed.

The ox-drawn plough must eventually succeed the hand-drawn plough, but this again will take time. A very small percentage of the farmers own cattle and the comparatively large herds seen about the Protectorate are owned by a few individuals. It will therefore be necessary in the first instance to encourage the ownership of a few cattle among a larger number of farmers rather than the continuance of the present system. The ravages of Rinderpest and other cattle diseases which decimate the herds each year will have to be brought under control before farmers can be expected to train oxen for ploughing.

Some practical assistance in this direction, possibly by the appointment of a veterinary officer, in the very near future is anticipated and arrangements have been made for Mr. R. E. Montgomery, M.R.C.V.S., Adviser on Animal Health, to the Secretary of State for the Colonies, to visit the Gambia towards the end of the year.

Through the kind co-operation of the Director of Agriculture, Nigeria, two locally made ox-drawn ploughs, such as are used in the Northern Provinces of Nigeria, are being sent to us for trial during the coming season. Experience has shown in Nigeria that a man with his wife and a boy can cultivate a farm of about 14 acres instead of one of three acres.

Arrangements were made for Mr. J. Pirie, Agricultural Superintendent, to visit India and Ceylon for the purpose of studying native methods of ploughing and irrigation. He is expected to return to the Colony in May when further methods will be considered. From the foregoing it will be seen that considerable attention is being devoted to this subject, but in view of the many complex questions which arise, progress at the very best can only be very gradual.

EXPERIMENT STATIONS.

Field Work.

From the establishment of this Department in 1924 to 1929, the field work was of necessity largely directed towards the reproduction of the various varieties of groundnuts, millets, guinea corn, maize, and similar crops introduced into the Colony, and the building up of stocks of seed and introduced plants for general distribution. A good stock of seed and plant material now being available it was possible to reorganise the field work to supply accurate information having a direct bearing upon some of the agricultural problems awaiting solution. Between 600 and 700 plots were laid out with various crops at Cape St. Mary and about 150 plots at the Wuli farm 250 miles up river.

The method employed in all experimental work is that of R. A. Fisher, of Rothamsted, whereby the plots are so arranged that they are amenable to statistical reduction of results. After a careful discussion between the staff officers of the various problems requiring investigation a full programme was drawn up limited only by the area of land available.

Credit is due to these officers for the patience and skill shown throughout in organising and training African assistants in the intricate details of this work.

Annual Report, Cape St. Mary Farm, 1930.

This farm was in charge of Mr. F. W. Hall, Assistant Director, throughout the year.

This farm is situated approximately 8 miles west of Bathurst on the sea coast, and covers, including the Botanic Gardens, Nurseries, etc., 33 acres. The following report refers to work carried out on the farm only. Detailed meteorological data are given in another part of this report. In previous years on the farm most of the crops had received dressings of artificial manures apart from heavy mulchings of grass rather masking the true nature of the soil. There were, however, a few plots where no manuring had been carried out and the resultant crops were poor.

It was known that the soil was poor and details of analyses will be found in the Annual Report for 1929–30, pages 27–49. From these it will be seen that there was little residual effect for the manures, and humus was lacking. Apparently that not utilised by the crops within the season was washed out of the soil. The lack of a green manure, or humus in the form of an adequate supply of rooted grass, etc., precluded any experiment with manurial treatment of any real value, and it was decided that under the circumstances experiments be confined to other subjects. It was realised that results might be poor, but it was expected they would furnish some information as to soil variation, and also act as a training ground for the African Staff in methods of experimentation of which they were ignorant, in addition to information for which they were designed.

Preliminary Work.

This consisted of clearing the land of its seed laden crop of obnoxious weeds, in measuring up the land and pegging the plots. All this was carried out before the wet season arrived.

Climatic Conditions.

The rains commenced on the 12th June and continued to 24th October, except for one precipitation which fell on 9th November.

Severe storms were experienced on seven occasions, the worst being that on the 16th August when 8·93 inches fell within 9 hours following 3·07 inches on the 10th July, when a good deal of damage was caused by wash. Every effort was made to protect plots by cutting drains around each individual plot. These adequately served the purpose until the 16th August, when the heavy rains falling on a soil already saturated with 3 inches which fell during the previous two days, damaged plots and experiments beyond repair, drains 2 feet in section being swept out of existence. Apart from this heavy storm and its effect the season was normal in all respects and all field operations were carried out under ideal conditions.

Preparation of Land.

A departure from previous years was made in that most of the land was prepared by means of the West Indian hoe (to those unfamiliar with the tool, or this name, it may be stated that it is a stout blade 9 inches long and 8 inches broad

with the handle set at right angles to it, and it is to be found in most tropical countries under a variety of names), with which the labour were not familiar. They soon took to it and within a week were as proficient with it as can be found elsewhere. During the period of preparation, small hand ploughs became available, and a limited area was ploughed with these chiefly as a trial.

In view of the nature of the experiments, chiefly with groundnuts, all cultivation was carried out on the flat, and not in ridges except where sweet potatoes were grown.

Sowing.

Sowing of crops commenced on the 21st June and continued at varying intervals in respect of experiments up to the end of July. After this date only miscellaneous lots of seed which arrived late were sown.

Growth.

Throughout, the climatic conditions were favourable to germination and unchecked growth, but it was very evident after germination that soil conditions were decidedly unfavourable to the grain crops. At the same time there was an unfortunate visitation by plague of grasshoppers (*Zonocerus variegatus*) during the early stages of growth, and they so attacked the struggling seedling Guinea corn and Pigeon pea than any glimmering hopes of obtaining results were soon extinguished. Measures were taken against them, but with only partial success, owing to their widely scattered nature in the district. Resowings were carried out, but they were too late in the season to make headway.

It was interesting, however, to note that without exception no Bulrush millet was touched. Frequently the grasshoppers were found resting in plots of the latter crops, but they always migrated to neighbouring Guinea corn when commencing to feed.

Bulrush Millet, however, though it escaped insect damage, was badly infected with Green Ear, Smut, and to lesser extent with Sugary Disease (*spacelia* sp.).

Rust, though present, was not much in evidence.

Groundnuts showed a fairly vigorous growth in the early stages, and gave promise of doing moderately well. Diseases began to appear towards the end of July in a few plots. A disease, since determined as *Macrophomina phaseoli*, was first in evidence, chiefly confined to the Philippine Pink variety. *Cercospora personata* made its appearance shortly after. The former disease did not appear to make much headway until the latter end of August. In the meantime *Cercospora* had spread rapidly, and affected all varieties, though all but Philippine Pink eventually overcame the disease. The weakening of Philippine Pink owing to heavy infestation with this disease, together with the poor soil and closer planting, allowed *macrophomina* to take a solid hold, and eventually many plants succumbed to this later; examination of dead plants showing numerous *sclerotia* on the roots.

About the middle of August, Rosette appeared and made slow progress on a few plots until early September, when it began to appear in most experiments. From observations it was fairly evident that aphis was the cause, and a few plants, infected with them in the wingless stage, were marked for observation. When these were matured Rosette gradually increased in severity, and within a fortnight the number of infections had increased enormously, in one particular experiment over 2,000 per cent.

Cultivation.

Throughout the growing season weeding was carried out, and generally plots were kept in a clean condition. In the case of some of the grain crops, inter-

cultivation was done by means of the light experimental ploughs previously mentioned with cultivator attachments giving satisfactory results.

All light drains were also kept open by means of these ploughs, and not only did they save much wash and damage, but they reduced the cost of upkeep enormously.

Harvesting.

Harvesting operations commenced towards the end of October, and continued through November, no difficulties or damage being experienced through the unexpected November storm.

Results and Notes on Experiments.

These were, for many of the reasons already given, very poor, and only those giving a little useful information are summarised at the end of this report.

The experiments laid down, and objects aimed at, were briefly as follows.

(1) *Groundnut Variety and Spacing Trial.*

Object.—Comparison of four varieties at varying spacings to find out the best spacing to adopt and the best variety as regards yield.

Remarks.—*See* Summary of Results.

(2) *Mixed Cropping Trial Basic Crop Groundnuts with Grains as Intercrop at Varying Spacings.*

Object.—To see to what extent intercropping with a food crop can be carried out without reducing the yields of the basic crop to an uneconomic level.

Remarks.—The intercrops were so poor that they produced no effect on the groundnut yields, there being ample accommodation for both crops under the poor soil conditions. Examination of the data, however, indicate a continuation of this experiment as a means of providing valuable and necessary information.

(3) *Groundnut Variety and Sowing Date Trial.*

Object.—Comparison of three varieties sown at intervals of 10 days throughout the normal planting season, to observe effect of sowing date, variety and interaction of these comparents with regard to disease and yields.

Remarks.—*See* Summary of Results.

(4) *Groundnut Variety Trial* (37 *Varieties*).

Object.—Comparison of yields and disease resistance with object of eliminating poorer types.

Remarks.—*See* Summary of Results.

(5) *Sweet Potato Trial.*

Five introduced varieties from the West Indies.

Object.—Comparison of yields of total, and number of potatoes to 1 lb.

Remarks.—Four replications were insufficient to overcome soil heterogeneity, and yield data, though suggestive, gave insignificant results. The number of potatoes to the pound were significant, and are given in the summary.

All the above trials were laid out in randomised blocks with replications of four, five (Latin Squares), and six. Except in the case of (4), all plots were $\frac{1}{40}$ acre.

The fertility gradient was found to be roughly from North to South. Owing to the shape of the farm, it was necessary in some cases to have the blocks also North and South. The ratio of width/length of the plots used was 1–1·2. By altering this to 1–4·8, it will be possible to arrange blocks across the fertility gradient.

Six replications are preferable to four.

Recent Introductions.

Eleusine Coracana.

Four new types were received from Uganda during the year, and these were grown for stock purposes. Of these, one is promising as a more or less naked seeded type.

Pigeon Pea (Cajanus indicus).

Fourteen different types, of which one is early maturing, were introduced from South India. These have been grown for increase.

Green Manure and Pulses.

Several *Phaseolus* spp., and various green manures were received from Nigeria too late for the rains. These are being increased under nursery conditions.

Yams.

A few specie arrived from Nigeria early in 1930, and these have been grown under nursery conditions for increase.

Summary of Results. Groundnut Variety and Sowing Date Trial. Treatments.

Three varieties were used: Philippine Pink, Philippine White, and Basse, and five sowing dates: 21st June, 30th June, 11th July, 21st July, and 30th July, giving in all fifteen treatments.

Arrangement.

The 15 treatments arranged at random in each of four randomised blocks. Spacing 2 feet by 1 foot, and plots $\frac{1}{40}$ acre each. Harvesting done by hand picking.

Yields of Nuts.

(Mean yield in cwts. per acre.)

Variety.			Mean.	S.E.
P. Pink.	Basse.	P. White.		
3·39	5·89	6·31	5·22	0·68

(Mean yield in cwts. per acre.)

Sowing Date.					Mean.	S.E.
21st June.	30th June.	11th July.	21st July.	30th July.		
7·72	5·99	4·26	4·79	3·32	5·22	0·88

Basse and Philippine White are superior to Philippine Pink. The sowing of 21st June was superior to all sowings in July.

Yield in Terms of Good Sound Kernels.

The kernels of small random samples of nuts from every plot were hand selected, and yield data worked out on these, *i.e.*, all shell, shrivelled and damaged kernels were excluded. This selection was probably more severe than would occur in the hands of buyers, while the hand picking of the crop naturally increased the quantities of the latter, as under field conditions threshing with sticks removes some of the empty shell, etc., before it reaches the local markets. The data therefore from this are of more practical value than that for unshelled nuts, though the crop is sold locally in the latter condition.

(Mean yield in cwts. per acre.)

Variety.			Mean.	S.E.
P. Pink.	Basse.	P. White.		
2·00	3·33	3·11	2·82	0·39

(Mean yield in cwts. per acre.)

Sowing Date.					Mean.	S.E.
21st June.	30th June.	11th July.	21st July.	30th July.		
4·45	3·77	1·92	2·41	1·44	2·82	0·51

Bare significance is attached to the value of Basse over Philippine Pink. The first sowing was significantly superior to any of the July sowings, and it will be interesting to see if this is maintained.

Percentage Infection with Rosette Disease.

(Percentage of plants infected with Rosette.)

Variety.			Mean.	S.E.
P. Pink.	Basse.	P. White.		
5·17	13·98	18·28	12·48	1·64

(Percentage of plants infected with Rosette.)

Sowing Date.					Mean.	S.E.
21st June.	30th June.	11th July.	21st July.	30th July.		
1·37	1·77	11·71	19·34	28·21	12·48	2·11

(Percentage of plants infected with Rosette.)

—	Variety.		
	P. Pink.	Basse.	P. White.
21st June ...	1·32	1·12	1·65
30th June ...	1·47	1·67	2·15
11th July ...	4·67	13·60	16·85
21st July ...	6·92	23·27	27·82
30th July ...	11·45	30·25	40·92

S.E. = 3·66.

It is evident that Philippine Pink is more resistant to Rosette than the other varieties, though this is only to be noted with later sowings. June sowing was definitely superior to July sowings irrespective of variety.

Note.—Under the topic of disease, it is to be recorded here that Philippine Pink was definitely more susceptible to *Cercospora personata* and *Macrophomina phaseoli* than the other varieties, the latter disease being confined to this one variety.

With regard to the first appearance of the disease on each plot, the following data are recovered.

	Sowing Date.						
	21st June.	30th June.	11th July.	21st July.	30th July.	Mean.	S.E.
Average number of days to 1st appearance of Rosette ...	81·6	70·0	53·6	50·0	33·9	57·8	3·64
Converted to Mean Date ...	11th Sept.	8th Sept.	3rd Sept.	9th Sept.	2nd Sept.	6th Sept.	—

From the significance above indicated it is evident that the appearance of the disease is seasonal, and little affected by the date of sowing.

It is to be remembered, however, that the June sowings were approaching maturity and growth negligible, and probably the period between actual infection and visible signs of the disease is longer with such plants as compared with the actively growing later sowings.

All volunteer plants were removed as soon as they appeared throughout the farm to avoid possible infection from such source.

Groundnut Variety and Spacing Trial.

—	Treatments.	Varieties.		
	Philippine Pink.	Philippine White.	Basse.	Gambian.
Spacings adopted ...	9 × 9	—	24 × 9	—
	12 × 6	—	18 × 6	—
	9 × 6	—	12 × 6	—
	6 × 6	—	9 × 6	—

Arrangement.—The 16 treatments arranged at random in each of 6 randomised blocks. The spacings adopted in the case of Philippine Pink are because of its upright habit, the others all being prostrate varieties. The Gambian farmer at present only grows the prostrate type, and his usual spacing approached 24 inches by 9 inches.

Yields of Nuts (after Deducting Amount of Seed used in Sowing).

(Average yield in cwts. per acre.)

—	Spacing.							
	9 × 9	24 × 9	12 × 6	18 × 6	9 × 6	12 × 6	6 × 6	9 × 6
P. Pink	2·83	—	2·95	—	1·43	—	1·22	—
P. White	—	4·14	—	6·43	—	7·14	—	6·59
Basse	—	4·58	—	5·80	—	6·57	—	6·92
Gambian	—	4·17	—	5·21	—	6·75	—	6·87

S.E. = 0·45.

It would appear that a closer spacing than 24 inches by 9 inches improves the yields per acre of the prostrate varieties. On the other hand, yields suffer significantly with closer spacings than 12 inches by 6 inches.

Philippine Pink on its spacings is inferior to all the other varieties, but it must be recorded here that *Cercospora personata* and *Macrophomina phaseoli* very seriously affected this variety, the others being, comparatively speaking, free. Owing to lack of definite information, it was not possible to arrange that the spacings for P. Pink would be comparable with those of the other varieties, and for this reason full value from this experiment was not possible. Observations, however, throughout the season were helpful in deciding that a fair relationship would be for Philippine Pink to receive two-thirds of the area per plant allotted to the prostrate varieties. The data were worked out separately for the three prostrate varieties, and indications were that on poor soil there is no difference between them as regards yield, while spacing generally gave the best results at 12 inches by 6 inches.

The Weight of Nuts per Bushel Measure.

(Average weight per bushel measure in lbs.)

—	Spacing.							
	9 × 9	24 × 9	12 × 6	18 × 6	9 × 6	12 × 6	6 × 6	9 × 6
P. Pink	24·12	—	24·25	—	24·42	—	23·96	—
P. White	—	18·79	—	21·08	—	22·92	—	21·96
Basse	—	21·29	—	22·71	—	23·50	—	25·62
Gambian	—	21·00	—	22·46	—	25·04	—	25·50

S.E. = 0·45.

There is a significant increase in the weight per bushel with Basse and Gambian with the 12 inches by 6 inches spacings, and over this with the former in the 9 inches by 6 inches.

Philippine White shows a significant increase up to 12 inches by 6 inches spacings. Philippine Pink shows no significant difference. This latter no doubt is due to the fact that the difference between the spacings was only slight.

Excluding Philippine Pink, and working out the data on the other three prostrate varieties, there is a significant and progressive increase in weight per bushel, as the spacing is reduced to 12 by 6 inches, 9 by 6 inches not being significantly better than 12 by 6 inches, but significant over other spacings. With regard to variety, P. White is significantly inferior to the other two. This point of yield per bushel is interesting, but as so many factors can have effect it will be necessary in future to decorticate samples to see in which direction the difference lies. It is quite likely that the difference may be due to a greater production of immature nuts on the widest spaced plants, which never covered the ground, and as every nut was hand harvested this may have adversely affected the wide spacing. This latter is also responsible for the general low weight per bushel measure, as, in ordinary field threshing with sticks, many of the empty and immature nuts would be eliminated.

Percentage Rosette Infection.

Rosette disease in this experiment was exceedingly slight, being much below that of any other experiment. Observations with such close plantings had to be made with extreme care and all African records were rechecked by a European on every occasion. During the earlier part of the season the amount of disease was so little that doubts were raised as to the advisability of proceeding with the observations, but it was decided to carry on as it served as the most critical test for the African assistants in their attention to detail. By the first week in September, it soon became evident that the laborious work might give some information. The following tables summarise the results. As it was impracticable to count the total plants per plot, the percentages were worked out as if a complete stand was obtained in all plots.

(Percentage infection with Rosette.)

—	Spacing.							
	9 × 9	24 × 9	12 × 6	18 × 6	9 × 6	12 × 6	6 × 6	9 × 6
P. Pink	0·34	—	0·22	—	0·24	—	0·10	—
P. White	—	3·12	—	0·25	—	0·23	—	0·34
Basse	—	1·82	—	1·06	—	0·40	—	0·10
Gambian	—	2·22	—	0·73	—	0·20	—	0·17

S.E. = 0·27.

(Percentage infection with Rosette.)

*Spacing.				Mean.	S.E.
24 × 9	18 × 6	12 × 6	9 × 6		
1·87	0·56	0·27	0·18	0·72	0·13

* Spacings of P. Pink are as in the first table, which is hardly legitimate. They are included, however, as the differences are obvious enough and, had they been excluded, the wider spacings would have a much greater value.

Errors are very high but there is sufficient evidence to indicate that the widest spacing is more susceptible to attack than any of the others. In every case, irrespective of variety, all spacings nearer than 18 by 6 inches covered the ground.

The results are interesting and a continuation of such observations is clearly indicated though with a more exact experiment.

It may be that the warm and dry conditions which go with a poor cover are more suitable to the aphis vector than the cool and humid conditions of a good

Variety.	Mean.				Order of Merit.					Ratio Yield/ per cent. Stand.	Years Grown.
	Per cent. Germination.	Per cent. Stand.	Per cent. Rosette of actual Stand.	Yield per acre in lbs.	Germination.	Stand.	Rosette.	Yield.	All Factors.		
Spanish No. 5 ...	49	62	71	161·1	21	19	14	25	23	2·6	3 (*a*)
„ 8 ...	66	80	54	201·8	15	11	3	21	14	2·5	3 (*a*)
„ 9 ...	58	71	74	94·1	19	16	17	30	24	1·3	3 (*a*)
„ 10 ...	75	83	60	221·7	9	10	6	20	11	2·7	3 (*a*)
West African ...	77	86	58	286·5	8	7	4	13	6	3·3	*
Spanish Poona ...	74	84	62	250·5	10	9	8	17	10	3·0	3
„ Bunch ...	58	70	58	171·1	19	17	4	23	19	2·4	3 (*a*)
„ Jalguan ...	27	35	61	42·1	27	25	7	35	26	1·2	3
Poona Local ...	77	85	81	100·7	8	8	23	29	20	1·2	3 (*a*)
Zaria	79	88	52	448·5	6	5	2	2	1	5·1	*
Java White ...	31	39	66	50 6	25	23	11	33	29	1·3	5
Improved American	39	50	84	135·1	24	22	25	27	27	2·7	3
Virginia Bunch ...	78	89	68	423·1	7	4	12	3	5	4·7	5 (*a*)
„ Runner ...	80	87	77	322·4	5	6	20	8	8	3·7	5
Jumbo	56	68	59	296·6	20	18	5	12	16	4·4	5
Natal	24	35	75	77·2	28	25	18	31	29	2·2	5 (*a*)
Falcon	73	84	76	247·2	11	9	19	18	17	2·9	3
Gambian	89	91	72	487·4	2	3	15	1	4	5·4	Local
Valencia	47	58	54	112·0	22	20	3	28	22	1·9	5 (*a*)
St. Vincent ...	29	36	77	165·8	26	24	20	24	26	4·6	3
Small Japan ...	44	53	69	68·4	23	21	13	32	25	1·3	3 (*a*)
Big Japan... ...	71	78	87	302·8	13	13	26	10	18	3·9	3
Small Japanese ...	24	39	72	47·3	28	23	15	34	28	1·2	3 (*a*)
Big Japanese ...	64	79	64	301·5	17	12	9	11	13	3·8	3
Coniage	90	95	68	367·6	1	1	12	5	3	3·9	*
Sine	83	91	81	350·6	3	3	23	7	7	3·8	*
Senegal	78	83	79	417·7	7	10	21	4	9	5·0	*
Baol	78	89	64	261·3	7	4	9	16	7	2·9	*
Gudiatham Bunch	63	75	68	136·6	18	14	12	26	21	1·8	3 (*a*)
Mauritius Local ...	73	83	80	229·2	11	10	22	19	18	2·8	3
Mauritius	81	93	82	195·6	4	2	24	22	15	2·1	7
Madagascar ...	65	80	65	286·5	16	11	10	13	14	3·6	3
Barbados	72	73	73	304·4	12	15	16	9	15	4·2	3
Pondicherry ...	78	89	65	356·2	7	4	10	6	5	4·0	3
Basse	78	87	74	270·8	7	6	17	15	11	3·1	Local
Philippine Pink ...	89	95	51	284·4	2	1	1	14	2	3·0	8 (*a*)
Philippine White...	62	79	61	270·8	14	12	7	15	12	3·4	8
Means	64·4	74·4	68·7	236·4	—	—	—	—	—	3·2	—
Standard Errors ...	2·55	3·56	9·66	67·3	—	—	—	—	—	—	—

* Introduced varieties all of West African origin.

(*a*) Upright varieties, all others prostrate. The errors for Rosette and yield are extremely high. Insufficient seed to increase replications and shape of available land necessitating blocks running with fertility gradient are chiefly responsible. On the present data all the West African varieties maintain a high position. In view of the fact that the spacing allowed was more than sufficient for growth during the season (no variety covered the ground), the column of ratio yield/per cent. stand was added as being of some interest and value. When sufficient seed is available other factors should be explored before elimination of varieties is undertaken. Yield being the most important factor, the order of merit for it is of most value. There is no sufficient difference between yields or order of merit from 1 to 12 inclusions.

cover. On the other hand, close spacing reduces period to maturity, therefore growths would probably be insufficient with the close spacings for visible signs to be shown when infection was most in evidence with the wide spacing.

Groundnut Variety Trial.

Varieties: 37 as given in the table on page 24A.

Arrangement.

Randomised in blocks.
Replications, 4.
Size of plots, 60 feet by 6 feet.
Spacing, 2 feet by 1 foot.
Blanks to be resown.

The following data were recorded and for sake of space the results are tabulated as shown.

Percentage germination with first sowing.
Percentage stand at harvest.
Percentage Rosette.
Actual yield.

Sweet Potato Variety Trial.

Varieties.—Five varieties introduced in 1929 from the British West Indies.

Arrangement.

Randomised in blocks.
Replications, 4.
Size of plots, $\frac{1}{40}$ acre.
Spacing, 3 feet by 1 foot, on ridges.

Number of Potatoes to 1 *lb.*

(Average number of potatoes to 1 lb.)

Variety No.					Mean.	S.E.
1	3	4	5	6		
10·43	6·57	4·39	5·54	4·46	6·28	0·87

Variety No. 1 is significantly inferior to all other varieties.

Relationship between Yield and Number of Potatoes to 1 *lb.*

The possible relationship of these factors was explored and a correlation of $-0{\cdot}82 \pm 0{\cdot}07$ was obtained, indicating that the higher the yield the greater the weight of the individual potato.

The actual mean yield per acre in tons was as follows:—

Variety No.

1.	3.	4.	5.	6.
0·85	2·21	2·79	1·68	2·28

As potatoes are peeled before consumption, the size and often shape must always be taken into consideration in assessing the relative values of the different varieties.

Annual Report, Wuli Farm, 1930.

This farm was in charge of Mr. T. R. Hayes, Agricultural Superintendent, throughout the year.

This farm is situated on the bank of the river opposite Basse, and is 250 miles distant from the sea. The land has been subjected to shifting cultivation in the past, but the soil is comparatively good, part of it being sandy, and part a heavier darker soil with a higher clay fraction, merging to swamp outside the farm.

During 1930 experimental work in the Protectorate was concentrated on this farm; all available land was stumped and brought into a condition suitable for small plot experiments. The neighbouring farm at Mansajang was utilised for increase work. Climatic conditions were favourable, the rainfall though rather light, being well distributed. Attacks of locusts impaired the value of cereal experiments to some extent, and disorganised farm routine, but the damage was much less than in the Protectorate generally, as these crops were grouped together and control was therefore more efficient.

In contrast with former years, there were no labour difficulties. A permanent gang of labourers were engaged, and by treating them in a manner similar to that employed by the natives for their "Strange Farmers," they worked regularly and well. With the diversification of crops at the farm, the labour requirements were fairly uniform throughout the rain season, and it was unnecessary to involve any of them in hardship through dismissal in the middle of the rains. Casual labour was also easy to obtain, a most unusual thing during the growing season, and due probably to the low prices of groundnuts during the previous trade season.

The African staff co-operated willingly, and once the methods of planting, observing, etc., were grasped, they proved very useful.

The land available was insufficient, and some experiments, as will be noted later, were so reduced in size that no significance can be attached to the results.

The three small plot experiments which follow immediately were designed by the Assistant Director.

Groundnut Variety and Spacing Trial.

Object.—The three varieties regarded as most promising, Philippine White, Philippine Pink and Basse, were compared with ordinary Gambia groundnuts. Four different spacings were employed for each, to discover the best planting distance, those for Philippine Pink being closer than the rest on account of its bunching habit.

Planting Distances (in inches).

	Philippine Pink.	Three Runner Varieties.
Widest	9 × 9	24 × 9
Wide	12 × 6	18 × 6
Near	9 × 6	12 × 6
Nearest	6 × 6	9 × 6

The 16 varieties were planted in $\frac{1}{4}$-acre plots, randomised in blocks, with four replications.

Germination.

Results are expressed as failures per cent.

Spacing.

Widest.	Wide.	Near.	Nearest.	Mean.
13·0	13·4	15·2	17·2	14·7

Z > 5 per cent. S.E. = 1·15.

Varieties.

P. Pink.	P. White.	Gambia.	Basse.	Mean.
11·4	21·9	12·4	13·1	14·7

Z > 1 per cent. S.E. = 1·15.

Conclusions.—There is a significant increase in percentage of failures of the closest spacing over the widest. As a number of failures have been observed to be due to rodents and birds, it is possible that closely sown seeds offer a better opportunity for depredation by these pests than the more sparsely sown. There is no significant difference in germination between Philippine Pink, Basse and Gambia, but Philippine White is seen to be much inferior to the others in this respect; consequently, in the selection work, Philippine White single lines were selected for good germination before yields were considered.

Yields.

Results are expressed in hundredweights per acre, and the amount of seed used for sowing has been deducted in each case.

Spacing.

Widest.	Wide.	Near.	Nearest.	Mean.
16·64	18·56	18·21	17·01	17·67

Z > 1 per cent. S.E. = 0·01.

Varieties.

P. Pink.	P. White.	Gambia.	Basse.	Mean.
18·26	17·25	17·57	17·89	17·67

Z > 5½ per cent. S.E. = 0·01.

Interaction.

—	P. Pink.	P. White.	Gambia.	Basse.
Widest ...	18·63	14·41	16·71	16·82
Wide ...	20·00	18·09	17·18	18·94
Near ...	17·28	18·74	18·59	18·24
Nearest ...	17·12	17·78	17·78	17·56

Z > 5 per cent. S.E. = 0·02.

Conclusions.—Philippine Pink in general gave the best yield, and at its optimum spacing (12 by 6 inches) gave 1 ton per acre, which was well over a hundredweight in excess of any other variety at its most favourable spacing.

Basse shows a significant, though slight, superiority to Gambia, taking the average of all spacings, whereas Philippine White is somewhat inferior in yield.

For Basse 18 by 6 inches was the best spacing, while for Gambia and Philippine White 12 by 6 inches was more suitable.

Taking spacing in general, planting too close or too wide gives a large diminution in yield, and this result is highly significant.

Weight per Bushel Measure.

(Results are expressed in pounds per bushel.)

Spacing.

Widest.	Wide.	Near.	Nearest.	Mean.
23·8	23	23·1	23·6	23·4

Z > 5 per cent. S.E. = 0·43.

Varieties.

P. Pink.	P. White.	Gambia.	Basse.	Mean.
24·3	22·2	23·4	23·6	23·4

Z > 1 per cent. S.E. = 0·43.

Interaction.

—	P. Pink.	P. White.	Gambia.	Basse.
Widest ...	25·0	22·8	23·6	24·0
Wide ...	23·9	21·8	23·0	23·4
Near ...	24·0	21·5	23·3	23·6
Nearest ...	24·1	22·6	23·6	23·4

Z > 5 per cent. S.E. = 0·77.

Conclusions.—The Z test invalidates the figures for spacing and interaction, but this was due to the low variance brought about by the different spacings. Therefore, it can be said that spacing had no effect on weight per bushel.

With regard to varieties, there is no significant difference in weight per bushel between Gambia, Basse and Philippine Pink, but Philippine White was inferior in this respect, and the difference has a high degree of significance attached to it.

Summary.—Philippine Pink was the best all-round crop ; between Basse and Gambia there was not much to choose, while Philippine White was inferior to the

other three in germination, yield, and weight per bushel. The most favourable spacings were : Basse, 18 by 6 inches ; Philippine White, Gambia and Philippine Pink, 12 by 6 inches.

This experiment will be repeated for at least another two years in order to eliminate seasonal effect.

Groundnut Sowing Date Trial.

Object.—To ascertain the best time for sowing two varieties of groundnuts, Philippine Pink (Bunch) and Gambia (Runner). Further, to see what diminution of yield may be expected when groundnuts are planted at less favourable times, to provide information when the question of planting other crops at these times is considered.

Five sowing dates were adopted, covering the whole range of normal practice, and the 10 variates were planted in $\frac{1}{8}$-acre plots, randomised in blocks, repeated four times. The Bunch was planted at 9 by 6 inches and the Runner at 18 by 24 inches.

Germination.

(Results are expressed as failures per cent.)

Varieties.

P. Pink.	Gambia.	Mean.
11·2	13·5	12·3

$Z > 1$ per cent. S.E. = 0·8.

Dates.

7th June.	21st June.	5th July.	19th July.	2nd Aug.
13·8	12·8	13·9	11·5	9·7

$Z > 5$ per cent. S.E. = 1·3.

Interaction.

—	7th June.	21st June.	5th July.	19th July.	2nd Aug.
P. Pink ...	10·5	12·1	10·3	13·2	10·1
Gambia ...	17·1	13·5	17·7	9·7	9·3

$Z > 1$ per cent. S.E. = 1·9.

Conclusions.—The two varieties show no significant difference in average germination over the whole period, but Philippine Pink shows a steadier germination than Gambia, which varies from 17·7 per cent. of failures on 5th July to 9·7 per cent. on the 19th July. There was no correlation between germination and the amount of rain falling during the week after each sowing; probably humidity is the controlling factor, but wet- and dry-bulb observations had not been established in time for this experiment.

Yields.

(Results are expressed as hundredweights per acre. The amount of seed used in sowing has not been deducted.)

Varieties.

P. Pink.	Gambia.	Mean.
20·10	16·88	18·48

Z > 5 per cent. S.E. = 0·96.

Sowing Date.

7th June.	21st June.	5th July.	19th July.	2nd Aug.
22·69	21·88	20·44	14·54	12·88

Z > 1 per cent. S.E. = 1·46.

Interaction.

—	7th June.	21st June.	5th July.	19th July.	2nd Aug.
P. Pink ...	23·41	24·35	22·23	16·38	14·04
Gambia ...	21·96	19·36	18·64	12·69	11·71

Z > 5 per cent. S.E. = 2·06.

Conclusions.—The yield of Philippine Pink exceeds that of Gambia considerably, but although this coincides with the result obtained in the variety and spacing trial, it should be noted that the spacing for Gambia proved to be too wide, whereas that of Philippine Pink was favourable.

With regard to sowing date, there is a highly significant reduction in yield of groundnuts sown after the middle of July; the latest sowing gave almost half the yield of the earliest, and replications of the experiment prove that this is not due to seasonal effect. It will remain to be considered whether the farmer would not be more profitably employed on the growing of late Koos at this period.

The interaction figures are not significant owing to the low value of " Z."

Weight per Bushel Measure.

Varieties.

P. Pink.	Gambia.	Mean.
23·7	24·4	24·1

Z > 1 per cent. S.E. = 0·15.

Sowing Date.

7th June.	21st June.	5th July.	19th July.	2nd Aug.
23·8	24·2	23·8	24·7	23·8

Z > 1 per cent. S.E. = 0·24.

Interaction.

—	7th June.	21st June.	5th July.	19th July.	2nd Aug.
P. Pink ...	23·1	24·5	23·0	24·1	23·5
Gambia ...	24·4	23·9	24·5	25·3	24·0

Z > 1 per cent. S.E. = 0·34.

Conclusions.—Gambia gave a somewhat heavier crop than Philippine Pink.

With Philippine Pink, the sowings of 21st June and 19th July were heaviest, though that of 2nd August is not significantly inferior to that of 19th July.

With Gambia, the sowing of 19th July gave a heavier crop than those of 21st June and 2nd August. In the absence of any regular gradation from earliest to latest, these results are difficult to interfere, and are probably influenced by local seasonal effects rather than by date of planting.

Rosette Disease.—A little Rosette disease occurred on the two last plantings of Gambia (27 plants affected), whereas in the Philippine Pink plots only three plants were diseased in one of the plots sown on the 2nd August.

Costs, etc.—Unfortunately, it was not possible to maintain accurate cost accounts this year, but three weedings were required for all Gambia plots, with the exception of the latest, which only needed two. All Philippine Pink plots were weeded twice only, and this would mean a considerable extra return to the farmer for labour expended, or, alternatively, it would leave him free to devote more of his time to food crops or to more groundnuts.

The last two plantings of Gambia were more difficult to lift, owing to the hardness of the ground at harvest time.

The first two sowings of Philippine Pink had to be harvested before the rains were finished. Owing to the serious danger of moulds developing under such conditions in native practice, it is inadvisable to plant this variety early, in spite of the higher probable yield.

Summary.—Both varieties gave a serious diminution of yield in the later plantings. With Gambia, the earlier it is planted the greater the crop. Owing to the early maturity of Philippine Pink, it is not advisable to sow it before the early part of July, owing to the danger of the resulting crop going rotten; late plantings of this type give lower yields, but the reduction is not so serious as with Gambia. As in addition it stands a lesser chance of being infected with Rosette disease, it is a suitable subject for late planting.

Benni Sowing Date and Variety Trial.

Object.—To compare the yields of Black and White Benni seed (*Sesamum indicum*) and to discover the best time of sowing. In addition, to find out what reduction in yield may be expected when sown near the end of the rains, when the demands of other crops on the farmers' time are low.

Five planting dates were adopted, ranging from the first rains to almost the end of the rain season. The 10 varieties were sown in $\frac{1}{8}$-acre plots randomised in blocks, the blocks being repeated four times.

The statistical value of the experiment was entirely destroyed by the incidence of disease. In severe cases the plant did not come to maturity. At the worst period of the disease seedlings were also affected, especially where thickly sown, the young plants wilting at the stem and dying.

Diseased stems, fruits and leaves were submitted to the Imperial Mycological Institute, who reported as follows :—

Leaves.—Isolated, somewhat angular spots with brown centres and darker margins were present, and also large, dead patches, due to the running together of spots. No fruiting fungus was detected on the dead areas, but they were covered on the upper surface by minute black dots having the structure of the sclerotia of *Macrophomina phaseoli* (Maubl.), Ashby ; pycnidia were apparently not present.

Stems.—Numerous reddish brown spots were present which penetrated the cortex to some depth. No fruiting fungus was detected, but tissue plantings have yielded two fungi, one having the spore sizes and characters of *Colletotrichum coffeanum*, Noack. (a conidial stage of *Glomerella cingulata*), and the other apparently identical with *Corynespora mazei*, Gussow, which was very probably secondary, as it is known only as a cause of leaf disease of melons and related Cucurbitacea.

Fruits.—Small spots with red raised centres were present on which no fruiting fungus could be detected. Plantings from the fruit wall yielded growths of the following fungi :—

Aerothecium lunatum, Wakker.

Nigrospora oryzae (B. and Br.) Petch.

Fusarium sp.

Brachysporium sp.

None of these forms has been recorded as the cause of a disease of sesame.

Comment.—The presence of *Macrophomina phaseoli* (*Rhizoctonia bataticola*) on the leaf spots suggests that it may have attacked the roots and a root disease be the real cause of the trouble, the stem, leaf, and fruit spots being due to infections by feeble parasites on the weakened plants. It has been pointed out in connection with the root disease of the groundnuts that the fungus would only attack the roots of plants growing under unfavourable external conditions.

It might be worth noting that *Corynespora mazei* (*Cercospora melonis Cke*) was the cause of a very serious disease of melons in glasshouse cultivation in England some thirty years ago, and was overcome by substituting resistant varieties.

It might, therefore, be the cause of an injurious leaf spot of melons or related plants in the locality where the sesame was grown.

The state of the disease on various dates of observation for each variety and planting date are set out in the table below :—

Dates of Observation.

	White.						Black.					
Date of Sowing.	28th July.	11th Aug.	23rd Aug.	30th Aug.	5th Sept.	19th Sept.	28th July	11th Aug.	23rd Aug.	30th Aug.	5th Sept.	19th Sept.
11th June ...	—	—	S.	S.	Med.	Med.	Med.	Med.	Bad	Bad	Bad	Bad
9th July ...	—	—	S.	S.	S.	Med.	Bad	Bad	Bad	Bad	Bad	Bad
6th Aug. ...	—	—	—	—	S.	Med.	—	—	—	—	S.	Med.
3rd Sept. ...	—	—	—	—	—	—	—	—	—	—	—	—
1st Oct. ...	—	—	—	—	—	—	—	—	—	—	—	—

Note.—S. = Slight. Med. = Medium.

The rainfall for the first, second and third week after each sowing was as follows :—

Sowing Date.	1st week.	2nd week.	3rd week.	Total.
11th June ...	2·19	2·58	1·11	5·88
9th July ...	0·97	0·95	1·12	3·04
6th Aug. ...	1·85	3·17	4·13	9·15
3rd Sept. ...	2·30	2·62	1·44	6·36
1st Oct. ...	0·92	0·40	1·21	2·53

It will be seen that the black was more susceptible to attack than the white. The early plantings were most attacked. Although the first planting was not quite so bad as the second, it is possible that when the disease had established itself on the first plantings, it was able to attack the second planting at a younger stage, and so do more damage.

As far as the first four plantings were concerned, there are indications that the disease was associated with light rainfall, yet it was noted that in the four replications of each variate, those on sandy soil were less badly attacked than plots.

It thus appears that to avoid the disease the following points should be observed :—

(1) Sow white Benni and not black.

(2) Choose sandy, well-drained soil.

(3) Broadcast the seed as thinly as possible, and do not rely too much on thinning out when weeding to get the correct spacing.

(4) Do not sow before 1st August.

Groundnut Selection Work.

This was commenced in 1929, when individual plant selections were made at harvest time for high and low yields, from a number of varieties under cultivation at Cape St. Mary. The progeny of each parent was counted and bagged. These were planted out in progeny rows in 1930, the number of kernels per 100 shells being calculated as an estimate of heaviness. The progenies of low-bearing parents were sown at regular intervals between the high-bearing lines.

This procedure is based on the assumption that, groundnuts being mostly self-fertile, a population of them will probably be a mixture of pure lines, good and bad, and by separating different lines and testing them, it should be possible to isolate strains possessing high-bearing or other desirable qualities.

The literature on the subject is scanty, but work that has been published shows that favourable results have followed this procedure in Texas and Madagascar, while in Java, pure line selection gave no increase in yield, except that some lines resisted bacterial attack better. In this last case it appears that the crop was already uniform ; in the present series of experiments, the amount of seed was necessarily insufficient to allow for the lines to be replicated, and individual pure lines compared with exactitude, but in the Philippine White series, the average yield of the high selection lines was significantly greater than that of the low selections, while in the case of " Gambia Special," the difference was sufficient to warrant a continuation of the line.

When seed was selected for size, appearance and shape from a bag of groundnuts (ordinary mass selection as practised in the Protectorate) no permanent

improvement is likely to ensue ; a good sized seed may provide more nourishment to the plant and enable it to make a better start than one of the lesser size, but it is just as likely to come from a plant having few seeds as from a high-yielding parent. Similarly, seed chosen for high weight per bushel from bulked groundnuts will give a high proportion of kernels suitable for sowing, but if sown on poor land or in a season of unsuitable rainfall, the resulting yield may be no greater or the crop heavier, than that grown from unselected seed of the same type. For example, a standard mixture of seed was sent from Cape St. Mary to the 12 seed farms in the Protectorate, and the weights per bushel of the resulting crop varied widely at Kansala, in the Bintang Creek the percentage of full shells to the total number was 85, while at Kerewan, on the other side of the River, it was only 33.

If and when the method of single line selection is found to effect a permanent improvement, a rough and ready method on the same principle can be recommended to farmers, so that a more immediate if lesser improvement can be effected during the longer process of testing and increasing an improved strain by the Department, and establishing it in the Protectorate.

Owing to the enormous expansion of the work entailed in each succeeding year, it was necessary to be somewhat ruthless in reducing the number of selections after harvesting, even at the risk of discarding good lines, while some varieties were scrapped *in toto*. In general, the numbers discarded amounted to 60 to 80 per cent. of the original total of selections. Next year it will be possible to replicate, so that a more precise estimate of the relative qualities of the lines can be obtained ; each year further strains will be discarded until, at the end of four or five years, the few best strains remaining will be mixed and tested thoroughly against ordinary seed and, if satisfactory, increased for distribution. This long period is necessary to eliminate seasonal effect, and to make sure that the lines come true to type. A slight amount of natural crossing has been noted by Van der Stok in Java, and although the possibility of lines not coming true to type is rather remote, with our limited knowledge on the subject it has to be considered.

In one of the Philippine White progeny rows, nine plants out of 30 were of quite a different type. It will be seen if they are really segregated on planting out next year.

Philippine White.

This variety, while a normal yielder, is characterised by low power of germination, and progeny rows were first rejected for poor germination, and selections for yield taken from the remainder. Germination of each line was compared with a moving average instead of the general mean, owing to the irregular nature of the soil, which affected germination.

Mean Yields (*in lbs. per* 100 *Plants*).

Selections from	Number of Lines.	Yield.
High-bearing parents ...	125	41·8
Low-bearing plants ...	14	37·7

Standard error of difference = 1·0. Therefore there is a significant superiority in yield of the selected lines.

Basse.

Among 57 selections, the correlation between number of seeds or kernels of parent and yield of progeny was nil.

Philippine Pink.

One hundred and twenty-one lines from high-bearing and 30 from low-bearing parents were planted out ; no significant difference in yields was obtained.

Mean Yields (in lbs. per 100 Plants).

From high-bearing parents	5·73
From low-bearing parents	5·67

Being a bunch variety, weights of progeny yields were small, and could only be determined to the nearest $\frac{1}{2}$ lb. with the means available.

Gambia Special Plant.

One specially large plant bearing 146 seeds was obtained from a native groundnut farm through the Travelling Commissioner, Kombo and Fogni. The yield of its progeny was compared with that of ordinary Gambia seed. The number of replications was insufficient to allow a standard error to be accepted, but the difference in yield was sufficient to warrant the continuation of the line.

Coinage Pink.

The " Coinage " strain grown by the Department was originally obtained from seed brought in by members of the " Coinage " tribe from French Country. It is a mixture of several district types, both pink and red kernelled, and this experiment, together with that of Coinage Red, is mainly concerned with the separation of the various types.

Four high-bearing types were interplanted with mixed Pink seed. In each case the yields of selections were less than the mean of adjacent controls.

Coinage Red.

This variety appears to be, on the whole, definitely inferior to Coinage Pink. From plants picked at random from an acre of mixed plants the following figures were obtained :—

Variety.	Number of Plants Examined.	Average Number of Seeds per Plant.
Coinage Pink ...	200	67·3
Coinage Red	26	33·1

Twenty-four lines of the Red type were isolated and grown. There was no correlation between yields of parents and progeny.

Bulked Individual Selections.

In the case of 19 other varieties of groundnuts, bunch and runner, the yield from 100 selected plants of each was bulked and compared with a selection of low-bearing parents. In the case of some of the runners appreciable increase of yield was obtained, but as some selections showed a decrease on control, no importance can be attached to the figures this year.

Seed from 1, 2 and 3 Kernelled Shells.

It is often stated, both in the literature and by Protectorate farmers, that seed from single kernel shells is inferior for sowing to that from shells containing two or three kernels. Experiments with Basse and Philippine White were laid down to investigate this point. During the present season, no appreciable differences have been noted in regard to germination or yield.

Groundnut Hybridisation and Botanical Studies.

Concurrent with the selection work, various types were crossed with a view to obtaining segregate with more favourable qualities than the parents, with special reference to Rosette disease. By crossing Philippine Pink with various runner types, it may be possible to obtain a type with the resistance to Rosette of the former with the habit of the latter. By combining two hairy types, an increase of hairiness may be obtained, the significance of which is noted later.

The technique of crossing is similar to that of other small legume flowers, but the time of emasculation is important. Valuable information was obtained through the courtesy of the United States Bureau of Plant Industry, but the best time, as far as the Gambia is concerned, was found to be 4 a.m., the flowers being pollinated with the male parent at sunrise. Owing to the limited knowledge available on the botany of the various groundnut types, which in many cases are alike in general appearance, it was foreseen that without such knowledge, it would be impossible in many cases to tell at an early stage whether a plant was indeed the result of a cross. In addition, such a study would help to eliminate identical types such as Mauritius (Gambia), Mauritius (India) and Pondicherry, all of which are supposed to have originated in Mauritius. There are 45 varieties under experiment by the Department, and it is necessary to reduce this cumbersome number by every available means.

By studying the correlations between flower characters and other factors it may be possible to select on flower characters alone by classifying the flower and vegetative characters according to each variety's resistance to Rosette disease, it may be possible to establish such correlations that crosses can be bred for any particular character, with the possibility of also breeding for resistance to Rosette. Consequently, the examination in detail of the flower, leaf and seed characters of 40 varieties was commenced.

The hairiness of the vegetative parts may be a factor in resistance to insect vectors of Rosette disease. Three grades of hairiness were noted (for fully grown plants) and it was found that many of the bunch varieties were in the higher grades. With the exception of local Poona, which was exceptionally hairy, all the runner varieties were in the lowest grade.

The flower colour ranged from pale yellow to deep chrome between varieties ; no natural divisions were found and six arbitrary grades were made for classification, this being the maximum number permitted by the fluctuations within types. There is a general correlation between outer rim and central part of standard and wing colour. A strong correlation exists between runner and deep coloured flower parts :—

Colour Grade, Outer Rim of Standard.

Grade :	1	2	3	4	5	6	Mean.
Number of runners	—	—	1	12	9	1	4·43
Number of bunch	1	14	2	—	1	—	2·22

The overlapping runner in grade 3 is local Poona again, which in many characters diverges from the normal runner varieties. Virginia bunch in Grade 5 is also an exception in many ways to the usual bunch type.

The difficulty encountered in classifying varieties is exemplified in the overlapping shown in the degree of lacination of the calyx teeth between such diverse classes as bunch and runner, although a definite correlation exists:—

Lacination of Calyx Teeth.

	Slight.	Medium.	Deep.
Runner ...	4	15	4
Bunch	10	7	1

Anthocyanin on the standard.—Six grades were made for this character, and the runner type was found to be correlated with large amount of anthocyanin.

Anthocyanin on Standard.

Grade:	1	2	3	4	5	6	Mean.
Runner	—	—	—	11	3	3	4·52
Bunch	1	1	12	1	2	1	3·47

Similarly, anthocyanin was found to be present in the main vein at base of leaflet in the case of half of the runner varieties, whereas only two bunch varieties showed this. The anthocyanin on the stem was found to be an unreliable character owing to the variation of shading by the leaves.

Condition of flowers at 3 p.m.:—It was noticed in the field that flowers of bunch varieties looked fresher in the afternoon than those of the runner. On keeping flowers of all varieties under controlled conditions in the laboratory, it was found that, with two exceptions, all the bunch varieties were comparatively fresh at 3 p.m., while all the runner were quite faded with the exception of Poona local. The difference in time of fading is likely to be connected with differences in the time the stigma is receptive, or with pollen-tube growth, and in either case may affect hybridisation.

Small Millets.

A number of small millets were introduced in 1929 from Trinidad, and increased at Cape St. Mary. They were re-sown and cultivated in various ways at Wuli Farm to ascertain the most economical treatment for each. The majority were a failure owing to unsuitable conditions and the attacks of locusts, which seemed to prefer the millets, allowing the weeds to choke what was left of them.

Panicum mileaceum.—The first heads were flowering on the 22nd July, 53 days after sowing. It should normally be ready before the earliest Findo, and in addition has good eating qualities. It therefore appears likely to prove an attractive crop to the farmer.

Eleusine (Ragi).—The first sowings suffered the same fate as the other millets. Later in the season, a further sowing was made and transplanted to ridges; this grew fairly well, the yield being approximately 1,000 lb. per acre. The only objection to this grain appears to be that it is rather hard and not very palatable unless mixed with other food.

Panicum miliare, P. crus-galli, and Setaria italica were also grown. Further experiments with these crops are desirable, and some may prove a good alternative or supplement to the Findo crop.

Maize.

Efforts are being made to improve the yield of Gambian maize. There are four main types grown in the Gambia: (i) "Suseo shoppo," a very early, light yielding variety; (ii) "Tarima," the main crop, maturing in August, of average yielding qualities; (iii) "Tubab Nyo Ba," a late-maturing form, said to be a heavy yielder; (iv) White maize. Some farmers prefer earliness to heavy yield, as little of the late variety appears to be grown in the Upper River. Yield appears to be very largely bound up with the question of fertility and suitable rainfall, but a number of imported maizes which yield well elsewhere are being tried; two of these yielded much better than Gambian maize, and while they are mostly late-maturing varieties, it may be possible to get them adopted if they prove consistently successful on the Government Farm. Controls consisted of alternate rows of Gambian maize (var. *Tarima*). Difficulty in obtaining a perfect stand was experienced owing to weevil attack reducing germination, and the yields of Sudan, native and Lagos White are not considered, owing to their poor stand. All the later varieties were attacked by a corn ear worm rather more than the Gambian maize, but damage was slight.

Yields (*in lbs. per* 100 *Plants*).

Variety.	Colour.	Average Number of Days to Maturity.	Yield.	Mean Yield, 2 Adjacent Controls.	Difference.
Hickory King...	White	122	4·0	6·0	— 2·0
Salisbury White	,,	118	6·0	5·8	+ 0·2
Potchefstroom Pearl... ...	,,	118	10·7	5·5	+ 5·2
Wisconsin	,,	118	4·2	8·0	— 3·8
Muratha	,,	118	11·2	10·0	+ 1·2
Kenya Hybrid	,,	118	14·3	5·0	+ 9·3
Sudan Native	Yellow	90	—	—	—
Sakatoon June White ...	White	118	8·3	13·0	— 4·7
Anveld...	,,	109	7·8	6·4	+ 1·4
Natal 8 Row	Yellow	113	4·2	5·4	— 1·2
Boesman	White	113	2·2	4·6	— 2·4
Gambian	Yellow	98	—	—	—

Eating qualities of all varieties are said to be equal to that of Gambian maize, except that the appearance of the White maizes is preferred to that of Yellow maize.

Seed from isolation plots or a little selfed seed of most varieties has been obtained.

Native Maize Selection.

Concurrent with the above trials, an attempt is being made to increase the yield of local maize, while retaining reasonable earliness. The ear-to-row method of selection is used. As with the imported maizes, stands were impaired to some extent by army worms and locusts, but remnants of selected cobs have been set aside for increase and testing, and new selections from a native field made for a new ear-to-row test.

Rice.

The rices of the Gambia, as elsewhere, are diversified both in variety and nomenclature. Varieties are generally not very pure, and, with a view to providing uniform varieties and to accumulate information for future work, 40 Gambian

varieties, together with two from Sierra Leone, were grown. Seed was taken from a few heavy identical heads of each variety. There being no convenient swamp land, a plot was levelled on the lowest part of the farm and rainfall supplemented by drains. These rices are generally grown under swamp conditions, but, although the plot was never under water for more than an hour or two after each heavy rain, 18 varieties came to maturity.

Pigeon Pea.

About 2 acres of this crop have been laid down at Mansajang Farm for increase. Fourteen varieties from India have been sown, and are growing well, the only pest being a cut worm which severs the stems of seedlings.

Cotton Selection Work.

Object.—To produce a type of cotton superior to that grown at present. The problem is being attacked from two opposite standpoints :—

(*a*) An attempt to improve the present handy native type by selecting for lint length.

(*b*) An attempt to select imported cotton of the Allen variety for resistance to pests and diseases, and for uniformity of lint length.

The time that could be devoted to this work was necessarily limited, but it was considered that such preliminary work as could be carried out would save time if ever the question of a cotton export trade was reopened in the future.

Attempts have been made in the past to build up a cotton-export trade by the introduction of American and Egyptian seed ; the indigenous native cotton is too short in length for the European market, although the lint is fairly good compared with Indian standards. As much as 60,000 lb. was exported in 1904, but the project was a failure as, at the price offered, it paid the native better to utilise the cotton for his own cloth making.

The native cotton at the present time is nearly all Bourbon, with faint traces of Upland and Peruvian. These traces are all that remain of the imported seed, and it appears that these extra varieties have a very poor survival value. It is therefore considered that more good is likely to ensue from improvement of the local type, than by acclimatisation of the Allen (American) type.

Selections from an acre of Allen cotton and from various native types were made in 1929, and as far as possible, selfed seed was obtained from the selected plants. During the present year, these were planted out in progeny rows, and detailed observations made on flowering, boll dropping, bud dropping, etc., of each plant, these observations had to be terminated before boll opening commenced, owing to unavoidable lack of continuity.

From a study of these plant diagrams it appears that the marked superiority of native cotton over the Allen variety in resistance to pests is due, in part at any rate, to its monopodial or tree cotton-like habit.

The Allen produces its flowers on long fruiting branches arising from the main stem, with a consequently long flowering and bolling period. The native cotton bears a large number of vegetative branches from which, at a certain stage in growth, many short fruiting branches make their appearance almost simultaneously. There is a limited time, after the rains with the many pests and diseases, and before the dry season has too great an effect on bud and boll dropping, when the plant can produce a good yield of unstained cotton.

When planted at the proper time, the native plant can therefore produce the bulk of its crop during this limited optimum period, whereas the Allen, no matter how it is treated, must perforce spread its flowering and fruiting time beyond this period and suffers from diseases and pests at the beginning and from drought at the end of the period.

Selfed seed has been obtained from all progenies, for re-selection next year.

Soya Beans.

Small quantities of five varieties from the Caucasus and Manchuria were sown; germination and yield were both very poor, and previous conclusions on the unsuitability of this crop are confirmed. The crop should not be entirely condemned however, as the Soya bean requires a specific bacteria for the root nodules and it has not yet been possible to introduce this.

Dura S.R.D. 55, Sudan Guinea Corn.

About 2 acres were sown at various times for increase; the earlier sowings were badly attacked by smut as soon as they headed. Owing to pressure of other work it was not possible to sow the bulk of the crop until the middle of August, which is later than is practicable for native varieties.

This suffered only very slightly from smut, and owing to its quick maturing qualities, a crop was reaped from it. Some of the grain was not fully formed, but while it is not recommended that it should be planted as late as this, it illustrates its suitability for late planting, and if this is brought into practice it will help to even out the labour demand.

Sukuta Fruit Farm.

This small farm of ten acres is being devoted to fruit cultivation with the object of stimulating fruit growing in this district so that the Bathurst market may be better provided with locally grown fruit. The permanent plots of young fruit trees have been regularly interplanted with groundnuts, pigeon peas, cooses, benni seed, maize and similar crops to supply seed for general distribution.

Mr. John Touray, African Assistant, has been in charge of this farm during the year with European supervision from Cape St. Mary, and good progress has been made.

The West Indian lime plots planted four years ago have done remarkably well and have produced crops equal to anything in the West Indies. The citric acid content of the juice being above the average and testing 15·8 ozs. per gallon. Orange, lemon, grapefruit, guava and sapodilla trees planted more recently are making good progress. Avocado pears and Canary Island bananas have also been planted and are doing well.

FORESTRY AND HORTICULTURE.

Tree Planting.

Forestry in this colony has not the same significance as it has in colonies possessing virgin forests with large areas of exportable timber. The work being carried out by the Department in this connection is more directly concerned with the introduction of economic trees and plants from without the Colony, and their

propagation for general distribution within the Colony. Previous to the establishment of this Department, the Gambia has been strikingly devoid of those trees and plants of economic or ornamental value, which render other tropical colonies so attractive.

To remedy this, a collection of plants of economic and ornamental value has gradually been built up at Cape St. Mary, where a small section of land comprising less than five acres has been set aside for this purpose.

This collection of plants is maintained for supplying our plant nurseries with material for propagation purposes from which the necessary plants are raised for distribution and planting up of public roads, open spaces and grounds of Government buildings in Bathurst.

The collection of plants instead of being established in uninteresting field plots has been set out attractively in the form of a Botanical Garden. It therefore serves a dual purpose as it provides an attractive and restful garden which is greatly appreciated both by residents of Bathurst as well as by visitors to the Colony. I would record that the annual cost of maintaining this section is £126 per annum.

In a Colony like this, which suffers from a complete absence of rain from seven to eight months each year, the work of establishing permanent trees of economic value about the Colony presents exceptional difficulties and there must always be a considerable loss, but the trees which do survive these adverse conditions more than repay for the losses which occur. Special attention has been devoted to propagation and planting of trees of economic value, either for fruit, shade or decoration, and 24,939 of such trees have been distributed from our plant nurseries at Cape St. Mary during the last five years. These include West Indian Cedar, British Honduras Mahogany, Eucalyptus, Casurina, Neems, Albizzia, Acacia, Bauhinia, Ficus, Lonchocarpus, Terminalia, Tecoma, Peltophorum Spathodea, Lagerstromea, Star-apple, Orange, Grapefruit, Tangerine, Mandarin, Guava, Mango, etc. Each plant is grown for at least twelve months in a kerosene tin in the nurseries before it is planted out in public thoroughfares. Planting is done as soon as the rains commence to give the trees a better chance of getting established before the rains cease. Daily watering is given during the following dry season and by the time the succeeding rainy season has finished the tree is sufficiently established to care for itself. Experience has proved this to be by far the most profitable and successful method of planting up public roads.

A complete avenue of mango trees was planted during the year along the Bathurst to Cape St. Mary road, a distance of nine miles. These trees are making good progress, and in addition to supplying food during certain months of the year provide welcome shade for the numerous palm wine carriers and other users of this road. Numerous flowering and shade trees have been planted in Bathurst and around the new bungalows and along the Marine Parade and Clifton Road.

A consignment of plants consisting of British Honduras Mahogany, Persian Lilac, Casurina, Sapodilla, West Indian Limes, Acacia Adansonia, Sapium Selifera, Mango, Pomegranate, etc., were shipped to the British Consul, Praia, Cape Verde, to assist in the re-afforestation work which is being undertaken by the Portuguese authorities.

Horticulture.

There has been a marked increase in the demand for ornamental and economic plants among residents of Bathurst during the last few years, and our resources have been taxed to their limit to meet it. This is a good sign as Bathurst was previously devoid of those ornamental shrubs and bushes which render most tropical towns so bright and attractive. The Government has set a good example by planting up the open spaces in Bathurst with decorative plants.

During the period under review the land from the Old Military Hospital to the Public Works running along the foreshore in front of Government House and the Colonial Secretary's bungalow was placed under the care of this department with a view to rendering it more attractive to the general public. Numerous flower borders and beds were laid out and planted with English flowers, intermingled with bougainvilleas, hibiscus, crotons, acalyphas, etc. A profusion of colour has been maintained throughout the dry season. Among the English flowers which helped to make such a fine display for several months in the year were :—Petunias, calendulas, bluelace flower, zinnias, phlox, dianthus, carnations, miniature sunflowers, African marigold, scabious, salvia, verbenas, gaillardias, nicotiana, coreopsis, calliopsis, etc.

Seats have been provided for the general public at suitable spots and a bandstand erected where the police band plays on Wednesdays and Sundays.

This extension of horticultural effort has met with keen appreciation by the African community.

The waste ground adjoining the Wireless Station in Wellington Street was also placed under the care of this Department during the year. This has been levelled and flower beds and borders laid out and planted with showy flowers and shrubs and arrangements have been made to establish grass lawns as soon as the rains commence.

Government House Grounds.

Working in co-operation with the Public Health and the Prison Departments, a considerable improvement has been effected in the grounds adjoining Government House. During the rains the greater portion of these grounds were under water for several months in the year. A good deal of filling up has already been done and flower beds and borders laid out and planted. A grass tennis court has been successfully established with Bermuda grass and a second grass court is in course of construction.

Market Gardening.

There has been an increase in the African owned vegetable gardens adjacent the agricultural station at Cape St. Mary. These gardens supply Bathurst market with English vegetables throughout the dry season and provide work for the women when their work on the rice farms has finished. The produce which consists mainly of tomatoes, peppers, chillies, lettuce, onions, beet, carrot, ockra, cabbage and spinach, etc., is well grown and is taken to the Bathurst market by motor lorry each morning. Seeds and young seedling plants raised in boxes by this department are issued free to these market gardeners to stimulate and encourage this growing industry.

Plant Nurseries.

The plant nurseries have been extended during the year to meet the increased demand for plants.

The following have been distributed from these nurseries during the year :—

Trees—

Fruit trees	1,924
Flowering trees	843
Ornamental shrubs	2,231

Seeds—		
Vegetable	pkts.	155
Groundnut	lb.	6,944
Maize	,,	1,120
Guinea corn	,,	9,366
Millet	,,	4,368
Seedlings—		
Flowering		24,250
Vegetable		2,390
Sweet potato		7,506

CATTLE DISEASE.

Cattle disease occurred among the herds of cattle in the following districts: Lower and Upper Baddibu, Eastern Jarra, Lower and Upper Saloum, Jokadu, Eastern Niamina, Wuli and Upper Niumi. The more serious outbreaks occurred in Upper Niumi where 208 cattle are reported to have died and in Upper Baddibu where 200 died. The cause of the outbreak in Upper Baddibu is reported as being due to cattle entering from Senegal. A total of 560 cattle are reported to have died in the various Provinces where outbreaks occurred.

AGRICULTURAL EDUCATION AND TRAINING.

Training of Government Teachers.

The training of Government teachers in Nature Study was continued by this department. It was arranged with the Superintendent of Education that the lectures should commence in February and continue until the summer vacation. Only one half of the teachers were available at a time so the same lecture had to be given twice. The lectures were made as simple as possible and covered the following ground :—

(*a*) The seed :—the parts of, the food in, germination of, the preparation of seed beds, etc.

(*b*) The root :—parts of, growth of, etc.

(*c*) The stem :—structure uses, propagation by use of.

(*d*) The leaf :—structure, uses of, etc.

(*e*) The soil :—composition of, humus in, water in, etc.

(*f*) Plant food :—use of green crops, farmyard manure, etc.

(*g*) Flowers :—parts, pollination.

(*h*) Seeds and fruits :—parts of, disposal of, uses of, etc.

(*i*) General :—nursery work.

(*j*) Field work.

Every alternate lecture was practical and all operations were carried out by the teachers themselves. These practical lectures were taken at Cape St. Mary on the Agricultural Department Farm, and were more welcome to the teachers than the theoretical lectures given in Bathurst.

Unfortunately owing to difficulty of transport they were not always able to come to Cape St. Mary and the result was that one class was sometimes well ahead of the other.

It was also inconvenient to the lecturer but every effort was made to try and keep the two classes at an equal step in the curriculum.

Owing to the demands of the field work of the department in the later stages it was not possible to give lectures the attention I should have liked.

The progress made I think may be considered fair, but the arrangements unsatisfactory to this department. All lectures should be given at the Agricultural Station where the lecturer can return immediately to his proper official duties without delay.

Training of African Assistants.

Good progress has been made in the agricultural training of youths at Cape St. Mary, the more intelligent labourers are being trained in the more complicated detail work connected with field experimental work such as will qualify them for junior posts on the staff of the department.

AGRICULTURAL LAUNCH.

With the object of effecting greater economy the departmental launch *La Semeuse* was handed over to the Marine Department. The services of this launch are still available for produce inspection and other important agricultural duties on the river.

STAFF CHANGES.

The director proceeded on leave on 2nd May and returned to the Colony on 17th July, 1930. During his absence the duties of director were performed by Mr. F. W. Hall, assistant director.

Mr. J. Pirie, Agricultural Superintendent, proceeded on leave on 21st March, 1930. Arrangements were made for Mr. Pirie to attend a Special Course in Field Technique at Cambridge University, and at the expiration of his leave to pay a special visit to India and Ceylon to study questions relating to irrigation and ploughing. Mr. Pirie is expected to return to the Colony, in May, 1931.

Mr. J. W. Sparrow, Agricultural Superintendent, proceeded on leave on the 31st August and returned to the Colony on 26th January, 1931.

Mr. T. R. Hayes, Agricultural Superintendent, proceeded on leave on 30th November, 1930, and returned to the Colony on 16th April.

Agricultural Overseers and Interpreters.—The appointment of Mr. D. S. Bass was terminated during the year.

METEOROLOGY.

The following are summaries of the observations recorded at the Agricultural Station, Cape St. Mary, for the year ending 31st December, 1930 :—

Rainfall.—The total rainfall for the year was 51·87 inches, this being less than an inch in excess of that for the previous year. The first shower fell on 12th June, when 0·49 inch was registered, and the last precipitation on 9th November, when 0·68 inch was recorded. A severe storm was experienced on 16th August, when 8·93 inches of rain fell and caused considerable damage.

Temperature.—The mean maximum temperature for the year was 82·3°, being 0·9° below that of the previous year. The mean minimum temperature was 69·4°, being 0·1° above that of the previous year. The hottest month of the year was July, when the mean maximum was 84·8°. The extreme maximum shade temperature recorded was 97° on 20th June, and the minimum shade temperature 58° on 5th February.

Humidity.—The mean relative humidity was 63·9 per cent., being 2·8 per cent. below that of 1929. The monthly mean range being 44 per cent. in April, and 85 per cent. in August. The usual Meteorological Report for 1930 follows :—

Meteorological Report for 1930.

Department of Agriculture, The Gambia.

Hours of Observation 9.00 a.m.

Station Cape St. Mary. 16° 40′ 24″ 13° 29′ 04″ H. 52.31.

Months.	Air Temperature.							Relative Humidity.	Rainfall—Inches.	No. of days in which rain fell.	Mean Rainfall in one day.	Date.
	Means.		Mean.	Absolute.								
	Max.	Min.		Max.	Date.	Min.	Date.					
January...	80·2	64·5	72·4	89	12th	62	8th	45	—	—	—	—
February	78·5	63·3	70·9	94	14th	58	5th	65	—	—	—	—
March ...	77·9	65·3	71·6	91	30th	62	23rd	70	—	—	—	—
April ...	80·3	66·2	73·2	88	30th	62	6th	44	—	—	—	—
May ...	77·2	64·2	70·7	86	8th	60	4th, 5th, 6th, 7th, 23rd	74	—	—	—	—
June ...	83·3	71·3	77·3	97	20th	64	4th, 28th	51	2·66	5	0·80	20th
July ...	84·8	74·8	79·8	95	12th	70	19th	76	11·53	16	3·07	10th
August ...	84·2	73·3	78·7	96	12th	70	8th, 9th	85	24·86	22	8·93	16th
September	84·2	74·3	79·2	89	20th	70	1st, 12th	76	10·07	18	2·35	20th
October	86·1	75·2	80·7	89	29th	71	11th, 21st, 22nd	72	2·75	12	0·61	20th
November	87·2	74·1	80·7	94	10th	70	9th, 21st	57	0·68	1	0·66	9th
December	83·7	66·1	74·9	91	4th	60	21st	52	—	—	—	—
Totals	—	—	—	—	—	—	—	—	52·55	74	—	—
Means ...	82·3	69·4	75·8	91·6	—	64·9	—	63·9	—	—	—	—

Main Sea Level determined from readings taken at gauge, Bathurst, over periods 1st January to 31st December, 1929.

Annual Rainfall, Bathurst, for the Years 1891–1930,

Showing Averages for the Last Four Decades.

			Inches.				Inches.
1891	...	...	53·41	1911	...	...	28·14
1892	...	...	51·13	1912	...	...	33·99
1893	...	...	77·89	1913	...	...	23·68
1894	...	...	55·86	1914	...	...	52·33
1895	...	...	66·86	1915	...	...	47·64
1896	...	...	51·18	1916	...	...	38·02
1897	...	...	33·61	1917	...	...	37·68
1898	...	...	48·65	1918	...	...	54·03
1899	...	...	56·59	1919	...	...	56·17
1900	...	...	43·38	1920	...	...	34·29
			—— 53·85 average.				—— 40·49 average

1901	...	...	45·31	1921	...	...	35·12
1902	...	...	29·42	1922	...	...	45·71
1903	...	...	57·13	1923	...	...	65·38
1904	...	...	38·02	1924	...	...	56·46
1905	...	...	64·16	1925	...	...	44·09
1906	...	...	64·33	1926	...	...	35·05
1907	...	...	34·00	1927	...	...	60·58
1908	...	...	43·54	1928	...	...	56·99
1909	...	...	39·23	1929	...	...	52·30
1910	...	...	44·00	1930	...	...	47·86
			—— 45·91 average.				—— 49·95 average.

CONCLUSION.

In bringing this report to a close, I desire again to record my appreciation of the efficient and loyal way in which all members of my staff, both European and African, have carried out their various duties during the year. My thanks are also due to the Directors of the Royal Botanic Gardens, Kew; The Imperial Institute; The Imperial Institute of Entomology; and the Imperial Mycological Institute, for assistance rendered during the year.

(Sgd.) ARCHIBALD J. BROOKS.

Director.

9th May, 1931.

WORK CONDUCTED AT THE IMPERIAL INSTITUTE DURING THE YEAR 1930 FOR THE GAMBIA PLANT AND ANIMAL PRODUCTS DEPARTMENT.

ECONOMIC INVESTIGATIONS AND ENQUIRIES.

During 1930 the following investigations and enquiries were carried out for the Gambia.

Groundnuts.—Twenty-two samples of undecorticated groundnuts, from imported varieties planted in the Colony, were submitted by the Department of Agriculture. They varied somewhat in the amount of husk present, but the kernels contained normal amounts of oil. The oils in every case possessed the usual appearance and were of satisfactorily low acidity.

The Department of Agriculture also forwarded a composite sample representing the groundnuts grown throughout the Colony and consisting of undecorticated nuts of rather mixed appearance. The kernels of the nuts contained 49·7 per cent. of oil, equivalent to 36·7 per cent. expressed on the entire nuts, which is a satisfactory yield. The oil was of good quality, containing only 0·85 per cent. of free fatty acids expressed as oleic acid.

A small sample of undecorticated groundnuts from a cargo stated to be unsatisfactory was forwarded by the Department for examination in order to ascertain, if possible, the reason for the complaint. The nuts mostly contained two kernels, which were of medium size and plump; the kernels yielded nearly 51 per cent. of oil, which is a normal amount, but the oil contained over 7 per cent. of free fatty acids (expressed as oleic acid), a figure considerably in excess of the maximum (2 per cent.) regarded as desirable for the oil from undecorticated groundnuts of good merchantable quality.

Tanning Materials.—An analysis was made of a sample of Acacia pods (*Acacia arabica* var. *Adansonii*) which had been collected on the Experimental Station at Cape St. Mary, for seed purposes in variety trials which are being arranged by the Royal Botanic Gardens, Kew. The pod-cases were found to contain 32·3 per cent. of tannin and to agree generally in composition with a sample of *Adansonii* pods from the Sudan previously examined at the Imperial Institute.

Papain.—A sample of papain submitted by the Department of Agriculture was of normal character, with a proteolytic activity slightly above that of ordinary commercial papain. It had been well prepared, and if consignments of similar papain could be forwarded they should be saleable in the United Kingdom in competition with the ordinary grade shipped from Ceylon.

Beeswax.—A sample of beeswax was forwarded by the Department of Agriculture in order to ascertain the possibility of reviving the export trade in this product from the Gambia. On chemical examination the wax was found to be of normal composition, and to have the usual characters of African beeswax. Manufacturers and brokers to whom it was submitted regarded it as of good quality, and considered that it would normally be worth £120 per ton in the United Kingdom, although in the current state of the market it might not realise so high a price.

Raffia.—The Department of Agriculture forwarded a sample of locally-prepared raffia, which was largely in the form of very narrow strands and generally considerably inferior in strength to the commercial product. Importers in London were

of opinion that such raffia would not be worth more than £30 per ton, with commercial raffia of good quality at £50 to £70 per ton.

Observations were furnished by the Imperial Institute regarding possible improvements in preparation, and it was suggested that further samples should be forwarded or a trial shipment sent to test the market.

Kapok.—In connection with the encouragement of kapok cultivation in the Gambia, information was furnished to the Gambia Farmers Co-operative Marketing Board with regard to the present position and prospects of the market for this product, together with current quotations for various grades of hand-cleaned and machine-cleaned kapok.

Ginger.—Information was furnished to an enquirer in Bathurst regarding the cultivation, preparation and marketing of ginger.

IMPERIAL INSTITUTE.

GAMBIA COURT.

Public Exhibition Galleries.

The exhibits have been overhauled and re-arranged and new printed labels prepared for them.

A panorama of the Groundnut industry is in course of construction, and is nearing completion.

A number of photographs, including general views and a series illustrating the Groundnut industry, kindly loaned by the Director of Agriculture, have been enlarged and placed on exhibition. Six carbon transparencies have also been made and fixed in the windows of the Court.

Lectures to organised parties from schools have been continued during the year, and duplicate specimens of products, literature and postcards relating to the Gambia have been distributed.

The public attendance in the galleries, including school parties, during the year was 608,886, an increase of over 200,000 as compared with the previous year.

NUMBER OF IMMIGRANT OR "STRANGE FARMERS" ENTERING THE GAMBIA ANNUALLY TO PLANT GROUNDNUTS.

Year.	Number.	Year.	Number.
1912	6,525	1922	20,566
1913	9,940	1923	17,383
1914	14,908	1924	14,188
1915	32,220	1925	14,652
1916	9,315	1926	13,553
1917	20,727	1927	17,237
1918	20,509	1928	20,640
1919	22,440	1929	18,874
1920	24,150	1930	16,592
1921	22,048		

TABLE SHOWING ANNUAL EXPORTS OF GROUNDNUTS FROM THE GAMBIA, 1900 TO 1930.

Year.	The Gambia.		*Saboya.		Total.	
	Tons.	Value.	Tons.	Value.	Tons.	Value.
		£		£		£
1900	35,507	204,052	298	1,789	35,805	221,841
1901	25,610	171,542	140	863	25,750	172,405
1902	31,612	193,486	—	—	31,612	193,486
1903	45,477	275,394	—	—	45,477	275,394
1904	43,436	229,287	—	—	43,436	229,287
1905	29,499	169,426	—	—	29,499	169,426
1906	36,050	278,055	—	—	36,050	278,055
1907	40,858	256,685	—	—	40,858	256,685
1908	31,964	245,084	—	—	31,964	245,084
1909	53,644	323,231	—	—	53,644	323,231
1910	58,456	387,942	—	—	58,456	387,942
1911	47,931	437,472	—	—	47,931	437,472
1912	64,196	502,069	—	—	64,169	502,069
1913	67,404	622,098	—	—	67,404	622,098
1914	66,885	650,461	—	—	66,885	650,461
1915	96,151	400,434	—	—	96,151	400,434
1916	46,366	506,098	—	—	46,366	506,098
1917	74,300	869,790	—	—	74,300	869,790
1918	56,490	800,319	—	—	56,490	800,319
1919	70,290	1,154,429	1,387	18,414	71,677	1,172,843
1920	84,037	2,322,032	1,153	76,412	85,190	2,398,444
1921	58,273	620,246	902	8,655	59,175	628,901
1922	62,978	767,197	1,822	13,692	64,800	780,889
1923	62,564	851,847	1,614	13,038	64,178	864,885
1924	58,980	841,693	1,642	20,232	60,622	861,925
1925	46,583	666,927	2,117	26,170	48,700	693,097
1926	57,344	818,884	3,728	43,694	61,072	862,578
1927	65,107	916,191	4,133	51,750	69,240	967,941
1928	74,442	1,092,790	2,330	29,463	76,772	1,122,253
1929	56,355	765,564	1,735	19,952	58,090	785,516
1930	74,761	867,634	3,815			

* Groundnuts in transit from Saboya, French Senegal through the Gambia, upon which a toll of 1s. per ton is levied.

AVERAGE LOCAL PRICE PAID FOR GROUNDNUTS FOR THE LAST THIRTY-ONE YEARS.

Trade	1899–1900 ...	Wharf Towns	1s. 6d. ... ...
,,	1900–1901 ...	,, ,,	1s. 6d. ... ...
,,	1901–1902 ...	,, ,,	2s. ... ...
,,	1902–1903 ...	,, ,,	1s. 4d., 1s. 2d. ... ...
,,	1903–1904 ...	,, ,,	1s. ... ...
,,	1904–1905 ...	,, ,,	1s. 1d. ... ...
,,	1905–1906 ...	,, ,,	1s. 3d. ... ...
,,	1906–1907 ...	,, ,,	1s. 3d. ... ...
,,	1907–1908 ...	,, ,,	1s. 9d. ... ...
,,	1908–1909 ...	,, ,,	1s. 1d., 1s. 2d. ... ...
,,	1909–1910 ...	,, ,,	1s. 4d. ... ...
,,	1910–1911 ...	,, ,,	2s. ... ...
,,	1911–1912 ...	,, ,,	1s. 6d. ... ...
,,	1912–1913 ...	,, ,,	2s. ... ...
,,	1913–1914 ...	,, ,,	2s. 1d. ... ...
,,	1914–1915 ...	,, ,,	4d., 1s. 2d. ... ...
,,	1915–1916 ...	,, ,,	1s. 10d., 1s. 2d. ... ...
,,	1916–1917 ...	,, ,,	2s. 4d., 1s. 2d. ... ...
,,	1917–1918 ...	,, ,,	2s. 6d. ... ...
,,	1918–1919 ...	,, ,,	2s. 7d., 1s. 2d. ... ...
,,	1919–1920 ...	,, ,,	5s. 3d. ... ...
,,	1920–1921 ...	,, ,,	2s. 9d. ... ...
,,	1921–1922 ...	,, ,,	2s. 3d. ... ...
,,	1922–1923 ...	,, ,,	2s. 4d., 1s. 4d. ... ...
,,	1923–1924 ...	,, ,,	2s. 5d. ... ...
,,	1924–1925 ...	,, ,,	2s. 4½d. ... ...
,,	1925–1926 ...	,, ,,	2s. 2¼d. ... ...
,,	1926–1927 ...	,, ,,	2s. 6d. ... ...
,,	1927–1928 ...	,, ,,	2s. 9d. ... ...
,,	1928–1929 ...	,, ,,	2s. 1d. ... ...
,,	1929–1930 ...	,, ,,	1s. 4d. ... ...
,,	1930–1931 ...	,, ,,	3s. 10½d. ... ...

Shipping Towns	1s. 9d.		
,, ,,	1s. 9d.		
,, ,,	2s. 3d.		
,, ,,	1s. 7d., 1s. 2d.		
,, ,,	1s. 3d.		
,, ,,	1s. 4d.		
,, ,,	1s. 6d.		
,, ,,	1s. 6d.		
,, ,,	2s.		
,, ,,	1s. 4d., 1s. 2d.		
,, ,,	1s. 7d.		
,, ,,	2s. 3d.		
,, ,,	1s. 9d.		
,, ,,	2s. 3d.		
,, ,,	2s. 4d.		
,, ,,	7d., 1s. 2d.		
,, ,,	2s. 1d., 1s. 2d.		
,, ,,	2s. 7d., 1s. 2d.		
,, ,,	2s. 9d.		
,, ,,	2s. 10d., 1s. 2d.		
,, ,,	5s. 6d.		
,, ,,	3s.		
,, ,,	2s. 6d.		
,, ,,	2s. 7d., 1s. 2d.		
,, ,,	2s. 8d.		
,, ,,	2s. 9d.		
,, ,,	2s. 3¾d.		
,, ,,	2s. 7d.		
,, ,,	2s. 10½d.		
,, ,,	2s. 4½d.		
,, ,,	1s. 7½d.		
,, ,,	7½d., 1s. 2d.		

NOTE.—The above prices are only an average for each trading season. For instance, in 1919–1920 as much as 8s. per bushel of 28 lbs. was paid, this being the highest price ever paid in the Gambia.

HARRISON AND SONS, LTD., Printers, 44–47, ST. MARTIN'S LANE, W.C.2.